

**FUNCTIONAL TESTING AND RADIATION  
EXPOSURE TEST REPORT**

**ON**

**A PASSIVE AUTOCATALYTIC  
RECOMBINER PLATE**

**For**

**Consolidated Edison Company  
Indian Point Station #2  
Buchanan, NY 10511**

9705290033 970516  
PDR ADDCK 05000247  
P PDR

**Functional Testing  
and Radiation Exposure  
Test Report**

**wyle**  
laboratories

REPORT NO. 45971-1  
WYLE JOB NO. 45971  
CUSTOMER  
P.O. NO. 618123  
PAGE 1 OF 86 PAGE REPORT  
DATE April 7, 1997  
SPECIFICATION(S) See References  
in Paragraph 5.0

1.0 CUSTOMER Consolidated Edison Company  
ADDRESS Indian Point Station, Broadway & Bleakley Ave., Buchanan, NY 10511  
2.0 TEST SPECIMEN Passive Autocatalytic Recombiner Cartridge  
3.0 MANUFACTURER NIS Ingenieurgesellschaft MBH

**SUMMARY**

(1) Passive Autocatalytic Recombiner Cartridge, as described in Paragraph 6.0 and hereinafter called the specimen, was subjected to a test program as required by Consolidated Edison Company Purchase Order 618123 and Wyle Laboratories' Test Procedure 45971, Revision A. This test program was performed March 6 through March 28, 1997.

The test program consisted of the following:

- Receipt Inspection
- Hydrogen Exposure Test (Wet and Dry) and Weight Test
- Radiation Exposure
- Post-Radiation Hydrogen Exposure Test (Wet and Dry) and Weight Test
- Post-Test Inspection

The specimen completed the required tests as specified in Wyle Laboratories' Test Procedure 45971, Revision A.

Test requirements, procedures, and results are described in Paragraphs 9.0, 10.0, and 11.0 of this report.

STATE OF ALABAMA } ss. Alabama Professional  
COUNTY OF MADISON Engineer Reg. No. 5268

Wade Dorland, PE being duly sworn,  
deposes and says: The information contained in this report is the result of complete and  
carefully conducted testing and is to the best of his knowledge true and correct in all  
respects.

Wade D Dorland  
Subscribed and sworn to before me this 9th day of April, 1997  
Susan A. Koser SEAL  
Notary Public in and for the State of Alabama  
My Commission expires September 1, 1997

Wyle shall have no liability for damages of any kind to person or property, including special or  
consequential damages, resulting from Wyle's providing the services covered by this report.

PREPARED BY Robert Hardy 4/9/97  
Robert Hardy, Project Engineer

APPROVED BY Don Smith 4/9/97  
Don Smith, Department Manager

WYLE Q. A. R. G. Thomas 4-11-97  
R. G. Thomas, Q.A. Manager

**wyle**  
laboratories

Huntsville, Alabama

(gsp)

## 5.0 REFERENCES

- Consolidated Edison Company Purchase Order No. 618123.
- Wyle Laboratories' Test Procedure 45971, Revision A.
- Wyle Laboratories' Quotation No. 543/3515/DB.
- Consolidated Edison Company Request for Quotation IP-96-0676, dated 12/17/96.
- 10 CFR 21, "Reporting of Defects and Non-Compliance."
- 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants."
- Wyle Laboratories' (Eastern Operations) Quality Assurance Program Manual, Revision 1.

## 6.0 SPECIMEN DESCRIPTION

The specimen for this test program consisted of the following item manufactured by NIS Ingenieurgesellschaft MBH:

- One (1) Passive Autocatalytic Recombiner Cartridge, approximately 45 cm x 20 cm x 1 cm, with an approximate weight of 1.0 kg. Serial No. 4167/CA/49.

## 7.0 QUALITY ASSURANCE

All work on this test program was performed in accordance with Wyle Laboratories' Quality Assurance Program, which complies with the applicable requirements of 10 CFR 50 Appendix B, ANSI N45.2, and the Regulatory Guides. Defects are reportable in accordance with the requirements of 10 CFR Part 21.

The Wyle Laboratories, Huntsville Facility, Quality Management System is Registered in compliance with the ISO-9001 International Quality Standard. Registration has been completed by Quality Management Institute (QMI), a Division of Canadian Standards Association (CSA).

## **8.0 TEST EQUIPMENT AND INSTRUMENTATION**

All instrumentation, measuring, and test equipment used in the performance of this test program was calibrated in accordance with Wyle Laboratories' Quality Assurance Program which complies with the requirements of ANSI/NCSL Z540-1, ISO 10012-1, and Military Specification MIL-STD-45662A. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

## **9.0 REQUIREMENTS**

The specimen shall be subjected to the following:

- Receipt Inspection
- Hydrogen Exposure Test (Wet and Dry) and Weight Test
- Radiation Exposure
- Post-Radiation Hydrogen Exposure Test (Wet and Dry) and Weight Test
- Post-Test Inspection

## **10.0 PROCEDURES**

### **10.1 Receipt Inspection**

An inspection was performed upon receipt of the specimen at Wyle Laboratories. The specimen was checked to ensure that it was as described in Paragraph 6.0. Additionally, the specimen was visually inspected for any physical damage. The specimen was weighed at ambient room temperature. The baseline weight of the specimen was determined to be 1025 grams.

**10.0 PROCEDURES (Continued)**

**10.2 Hydrogen Exposure Tests**

**10.2.1 Hydrogen Exposure Test - Dry**

The specimen was subjected to a Hydrogen Exposure Test by placing it inside a test fixture as shown in Photographs 1 and 2 in Appendix II. A gas mixture of dry air with 1% hydrogen gas was then introduced into the test fixture at a flow rate of 3.6 to 4.0 scfm to provide a 0.3 to 0.5 m/s velocity across the face of the cartridge. The air temperature was measured at the inlet to the specimen and at the outlet of the test fixture as shown in Photograph 3. Additionally, the temperature in the catalyst bed, approximately one-third from the bottom of the specimen, was measured. The duration of the Hydrogen Exposure Test - Dry was one hour. Temperature plots of the Hydrogen Exposure Test - Dry are contained in Appendix IV.

**10.2.2 Weight Test**

The specimen was placed in a container of room-temperature tap water so that it was fully submerged. The specimen was allowed to soak for one hour in the water. Following the one-hour soak, the specimen was removed from the water and weighed every 5 minutes for 30 minutes to determine the effects of the water on the weight of the specimen. The results of the Weight Test are contained in Table I in Appendix I.

**10.2.3 Hydrogen Exposure Test - Wet**

The specimen was subjected to a Hydrogen Exposure Test - Wet by taking it immediately from the conclusion of the Weight Test detailed in Paragraph 10.2.2 and subjecting it to a Hydrogen Exposure Test as detailed in Paragraph 10.2.1. The duration of the Hydrogen Exposure Test - Wet was one hour. Temperature plots of the Hydrogen Exposure Test - Wet are contained in Appendix IV.

**10.3 Radiation Exposure**

Prior to irradiation, the specimen was verified to be dry by weighing it and confirming a return to essentially its baseline weight. The specimen was exposed to gamma radiation using a Cobalt-60 source. The total dose for the exposure was 1.04E7 rads gamma.

One thermocouple was placed in the specimen catalyst bed to monitor catalyst temperature during the radiation exposure. The highest temperature of the catalyst bed was determined to be 77.3°F as detailed in the Georgia Institute of Technology report covering the Radiation Exposure of the specimen. The Georgia Institute of Technology report is contained in Appendix III.

**10.0 PROCEDURES (Continued)**

**10.4 Post-Radiation Hydrogen Exposure Tests**

**10.4.1 Post-Radiation Hydrogen Exposure Test - Dry**

The specimen was subjected to a Hydrogen Exposure Test by placing it inside a test fixture as shown in Photographs 1 and 2. A gas mixture of dry air with 1% hydrogen gas was then introduced into the test fixture at a flow rate of 3.7 to 3.9 scfm to provide a 0.3 to 0.5 m/s velocity across the face of the cartridge. The air temperature was measured at the inlet to the specimen and at the outlet of the test fixture as shown in Photograph 3. Additionally, the temperature in the catalyst bed, approximately one-third from the bottom of the specimen was measured. The duration of the Post-Radiation Hydrogen Exposure Test - Dry was one hour. Temperature plots of the Post-Radiation Hydrogen Exposure Test - Dry are contained in Appendix IV.

**10.4.2 Post-Radiation Weight Test**

The specimen was placed in a container of room-temperature tap water so that it was fully submerged. The specimen was allowed to soak for one hour in the water. Following the one-hour soak, the specimen was removed from the water and weighed every 5 minutes for 30 minutes to determine the effects of the water on the weight of the specimen. The results of the Post-Radiation Weight Test are contained in Table II in Appendix I.

**10.4.3 Post-Radiation Hydrogen Exposure Test - Wet**

The specimen was subjected to a Post-Radiation Hydrogen Exposure Test - Wet by taking it immediately from the conclusion of the Weight Test detailed in Paragraph 10.4.2 and subjecting it to a Post-Radiation Hydrogen Exposure Test as detailed in Paragraph 10.4.1. The duration of the Post-Radiation Hydrogen Exposure Test - Wet was one hour. Temperature plots of the Post-Radiation Hydrogen Exposure Test - Wet are contained in Appendix IV.

**10.5 Post-Test Inspection**

The specimen was visually inspected following the completion of the test program.

## 11.0 RESULTS

A visual inspection of the specimen prior to and following the test program revealed no discernible differences in the specimen appearance.

The results of the Pre-Radiation Exposure testing and the Post-Radiation Exposure testing revealed that the specimen's exposure to radiation had essentially no effect on its performance.

The following appendices are included in this report:

Appendix	Contents
I	Tables
II	Photographs
III	Radiation Facility Report
IV	Hydrogen Exposure Test Plots and Thermocouple Locations
V	Instrumentation Equipment Sheets
VI	Hydrogen Gas Certifications
VII	Wyle Laboratories' Test Procedure 45971, Revision A

**APPENDIX I**

**TABLES**

**This page intentionally left blank.**

**TABLE I**

**PRE-RADIATION WEIGHT TEST**

<b>Point of Weight Test</b>	<b>Weight in grams</b>
First weight	1042
5 minutes	1036
10 minutes	1035
15 minutes	1034
20 minutes	1033
25 minutes	1032
30 minutes	1032

**TABLE II**

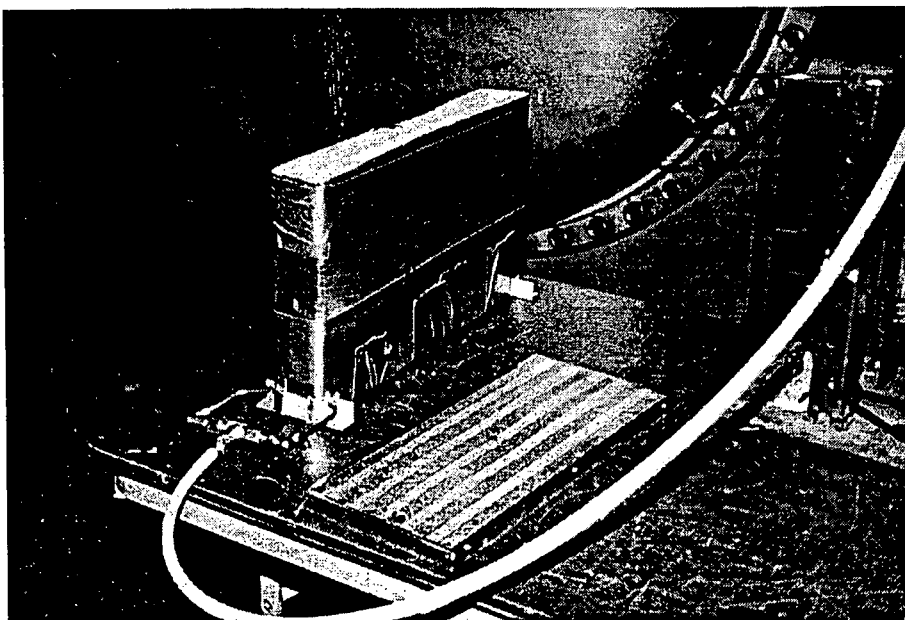
**POST-RADIATION WEIGHT TEST**

<b>Point of Weight Test</b>	<b>Weight in grams</b>
First weight	1039
5 minutes	1035
10 minutes	1034
15 minutes	1033
20 minutes	1032
25 minutes	1031
30 minutes	1031

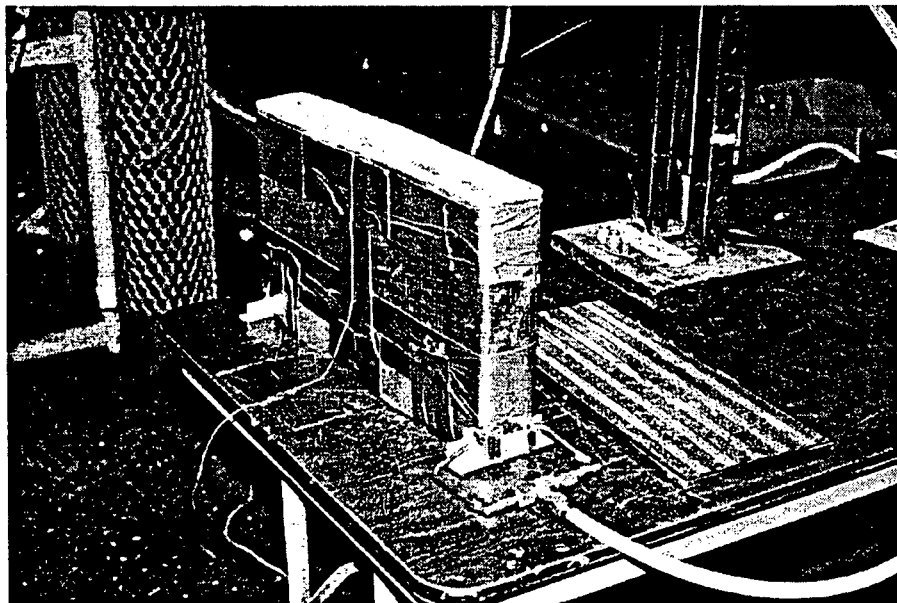
**This page intentionally left blank.**

**APPENDIX II**  
**PHOTOGRAPHS**

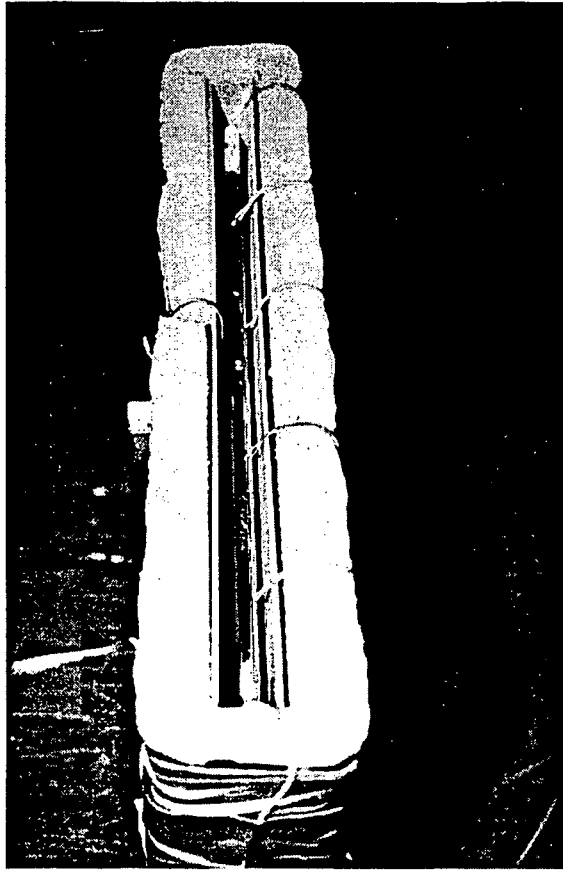
**This page intentionally left blank.**



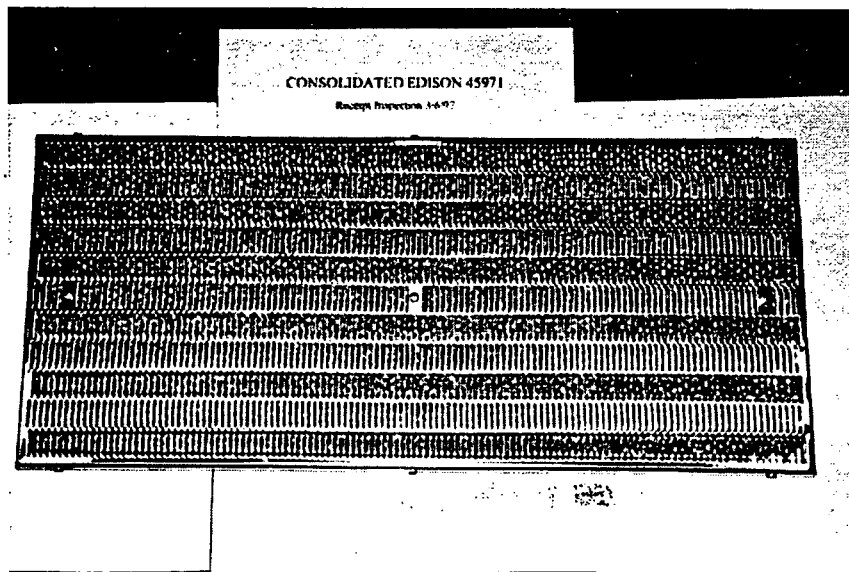
**PHOTOGRAPH 1**  
**HYDROGEN EXPOSURE TEST FIXTURE**



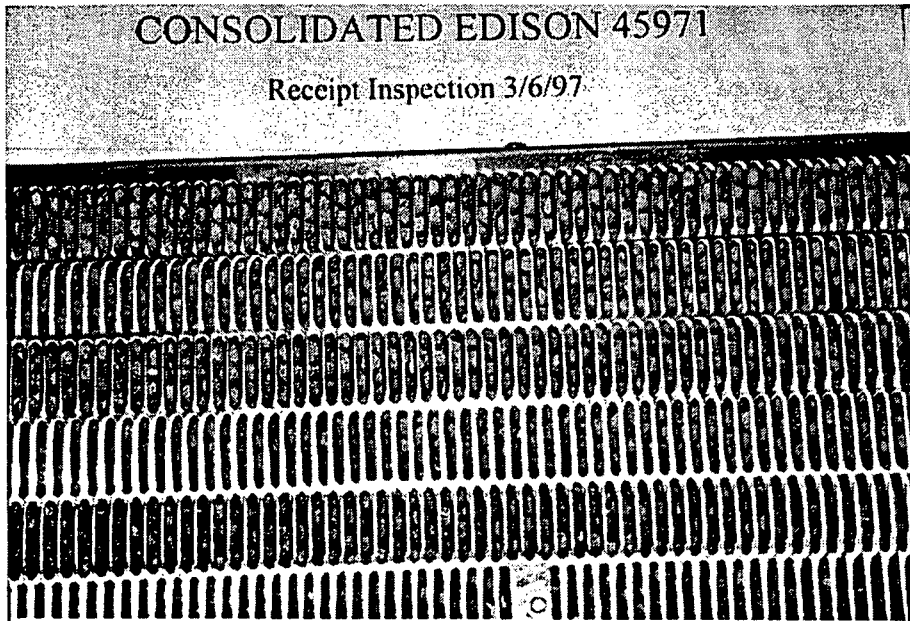
**PHOTOGRAPH 2**  
**HYDROGEN EXPOSURE TEST FIXTURE**



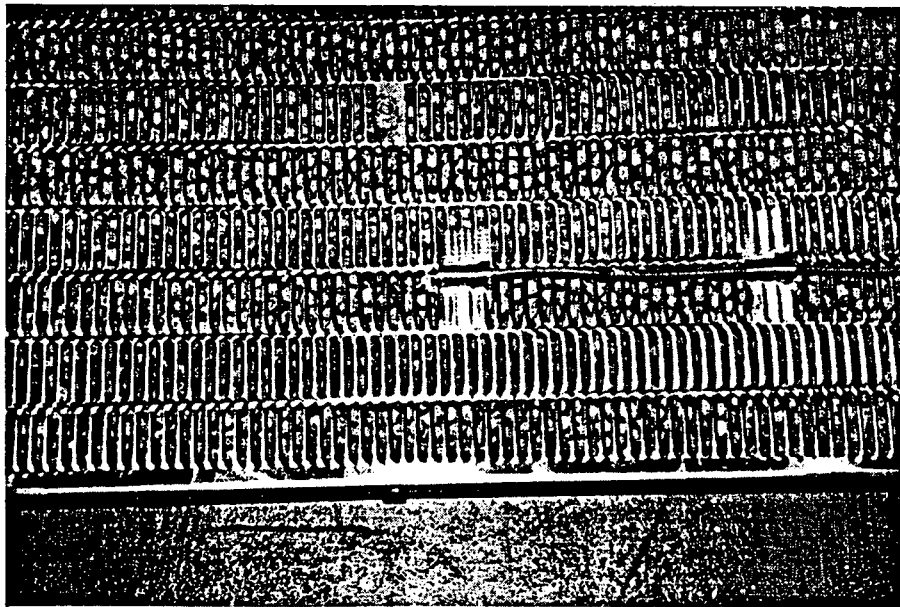
**PHOTOGRAPH 3**  
**SPECIMEN INSTALLED IN TEST FIXTURE WITH FIVE**  
**THERMOCOUPLES TO MONITOR OUTLET TEMPERATURE**



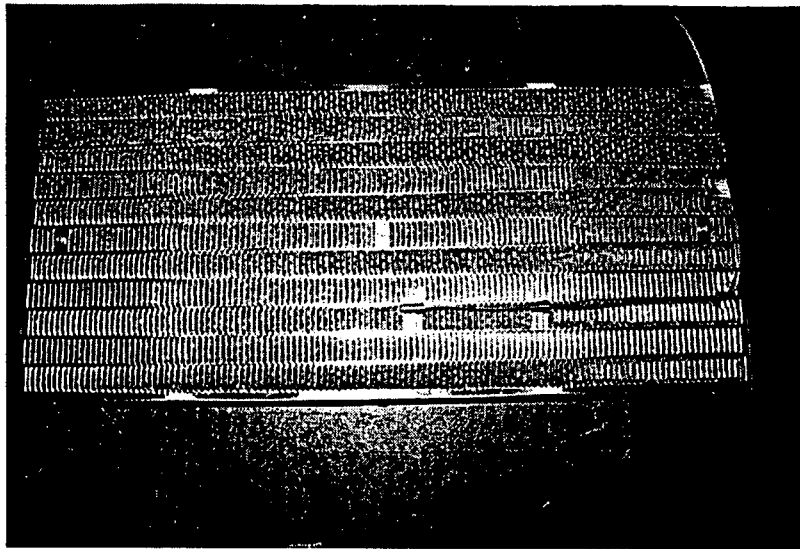
**PHOTOGRAPH 4 - RECEIPT INSPECTION**



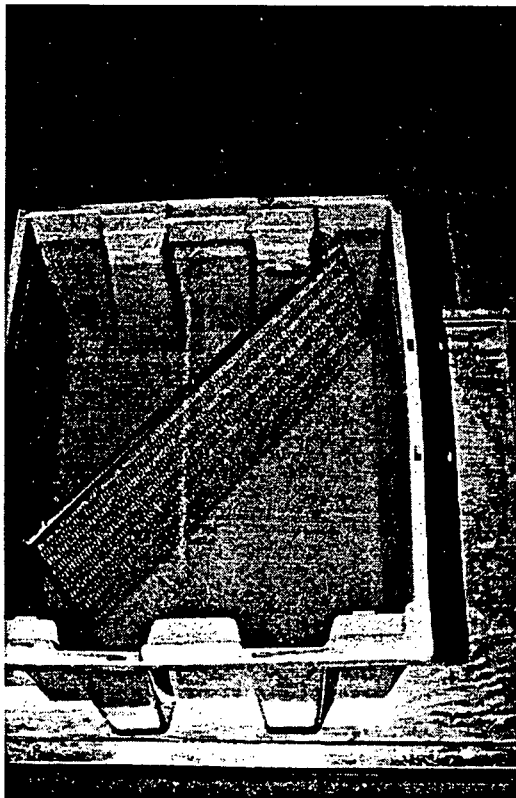
**PHOTOGRAPH 5  
RECEIPT INSPECTION**



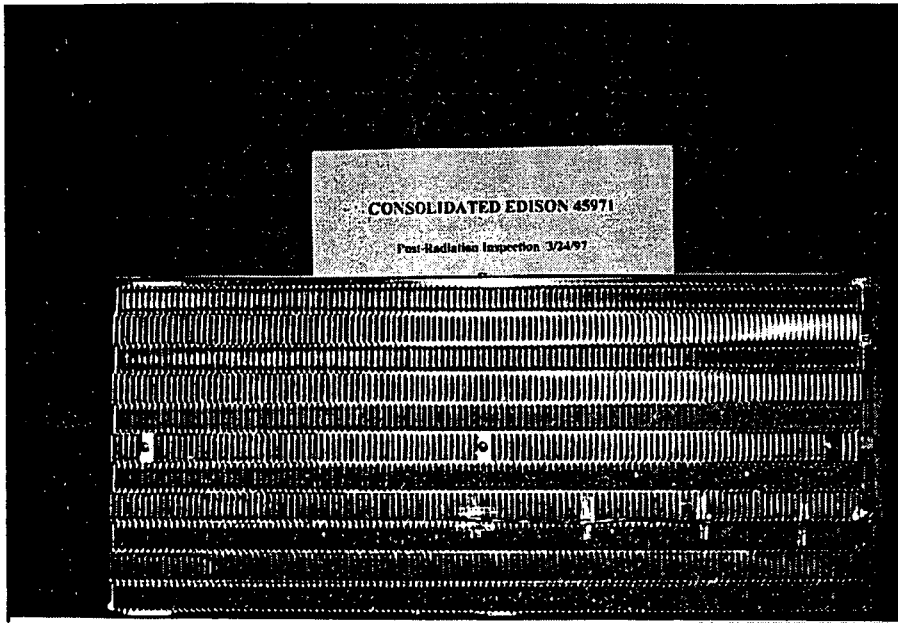
**PHOTOGRAPH 6  
PLACEMENT OF THERMOCOUPLE NO. 6 IN CATALYST BED  
FOR HYDROGEN EXPOSURE TESTS**



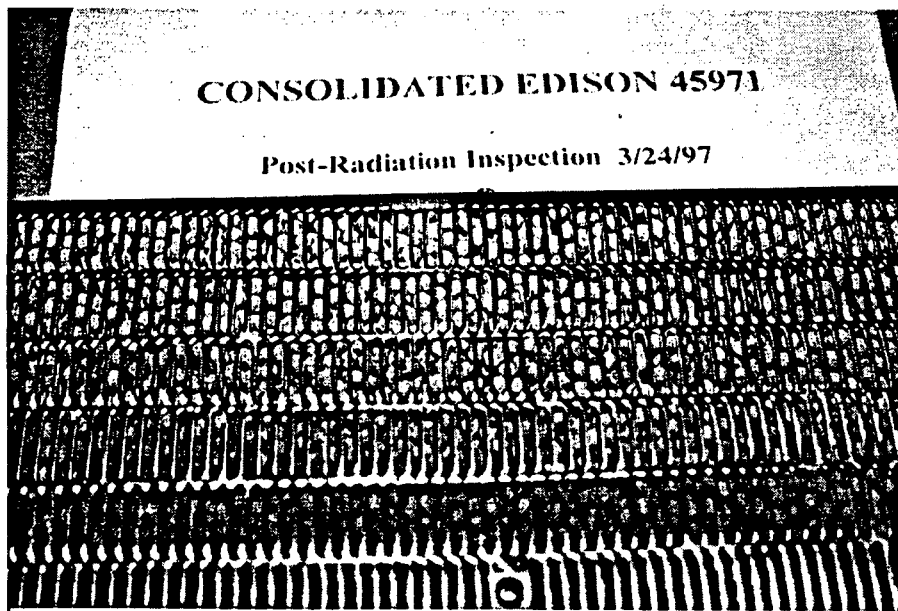
**PHOTOGRAPH 7**  
**PLACEMENT OF THERMOCOUPLE NO. 6 IN CATALYST BED**  
**FOR HYDROGEN EXPOSURE TESTS**



**PHOTOGRAPH 8**  
**SPECIMEN SUBMERGED IN ROOM TEMPERATURE**  
**TAP WATER FOR THE WEIGHT TESTS**



**PHOTOGRAPH 9**  
**POST-RADIATION INSPECTION**



**PHOTOGRAPH 10**  
**POST-RADIATION INSPECTION**

**This page intentionally left blank.**

**APPENDIX III**  
**RADIATION FACILITY REPORT**

**This page intentionally left blank.**

Home of the 1996 Olympic Village

# Georgia Institute of Technology

Neely Nuclear Research Center  
Hot Cell Operations  
900 Atlantic Drive  
Atlanta, Georgia 30332-0425  
(404)-894-3608 Fax: (404)-894-9325

20 March 1997

45971

2 3

Wyle Laboratories  
7800 Highway 20 West  
P.O. Box 77777  
Huntsville, AL 35807-7777

Attention: Bobby Hardy

Client Reference: 4-2188-P  
GT Reference: 97-02

Gentlemen:

The items covered by the above numbers have been irradiated in accordance with quality assurance requirements using Cobalt-60 (gamma energies 1.173 Mev, 1.331 Mev) to the total dose requested.

We certify the specifics of the irradiation as follows:

Irradiation Period: Interval between 17:20 on 03/19/97 and 15:26 on 03/20/97 as shown on the enclosed Gamma Irradiation Log Sheets.


Dose Rate: 4.73 E5 Rads/hr average (Air Equivalent); maximum error plus or minus 4.51%.

Total Dose: 1.04 E7 Rads (Air Equivalent); maximum error plus or minus 4.51%.

Dose Measurement: Keithley autoranging picoammeter model 485 with LND ionization chamber probe. Calibration by GA Tech traceable to NIST Cobalt-60.

The specific calculations for the irradiation are enclosed. Please let me know if any additional information is required.

Yours truly,



Peter G. Newby  
Manager, Hot Cell Operations  
Neely Nuclear Research Center

PGN/ars

Enclosure (s)



Home of the 1996 Olympic Village

# Georgia Institute of Technology

Neely Nuclear Research Center  
Hot Cell Operations  
900 Atlantic Drive  
Atlanta, Georgia 30332-0425  
(404)-894-3608 Fax: (404)-894-9325

20 March 1997

Wyle Laboratories  
ATTN.: Bobby Hardy  
7800 Highway 20 West  
P.O. Box 77777  
Huntsville, AL 35807-7777

Mr. Hardy,

In regards to the irradiation of your Passive Autocatalytic Recombiner Plate (NNRC Reference 97-02), the temperature of the plate was monitored using a type T thermocouple and a thermocouple reader supplied by Wyle Laboratories. During the irradiation, the temperature of the plate did not exceed 77.3 °F. The heating of the plate was most likely due to the mercury vapor lamps which illuminate the hot cell. If you have any further questions in regards to this issue, please do not hesitate to call me.

Sincerely,

Peter G. Newby  
Manager, Hot Cell Operations

**DOSE RATE MEASUREMENT SHEET**  
**KEITHLEY PICOAMMETER MODEL #485**  
**LND IONIZATION PROBE**

Client: Wyle Laboratories

N.R.C. Reference: 97-02

Reference P.O.: 4-2188-P

Date: 03/20/97

Probe: NNRC #106

Picoammeter: 375586

1. For an LND response of  $3.69\text{E-}8$  Amps or greater use the following equation with  $\pm 4.51\%$  uncertainty:

$$\text{Dose Rate (rads/hr)} = 9.039\text{E+17} * (\text{AMPS})^2 + 5.872\text{E+11} * (\text{AMPS}) - 4819.380$$

Where AMPS is the reading from the Keithley picoammeter in amps.

2. For an LND response of  $3.69\text{E-}8$  Amps or smaller use the following equation with  $\pm 5.95\%$  uncertainty:

$$\text{Dose Rate (rads/hr)} = 2.616\text{E+18} * (\text{AMPS})^2 + 4.515\text{E+11} * (\text{AMPS}) - 2143.715$$

Where AMPS is the reading from the Keithley picoammeter in amps.

Picoammeter Reading (Amps)	4.68E-7	4.74E-7	4.68E-7	4.78E-7			
Dose Rate (Rads/hr)*	4.67E5	4.76E5	4.67E5	4.82E5			

\*Please refer to attached drawings for dose rate measurement points.

Performed by: *Paul S. Nank*

Date: 3-20-97

Reviewed by: *Dy P. H.*

Date: 3-21-97

### Gamma Irradiation Log

Client: Wyle Laboratories

Item: Recombiner Plate

P. O. Number: 4-2188-P

Total Dose: 1.0 E7 Rads(w/Unc.)

NNRC Ref: 97-02

Dose Rate:  $\leq 5.00 \text{ E5 Rads/hr}$

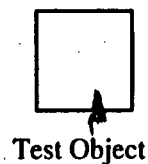
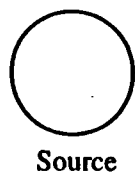
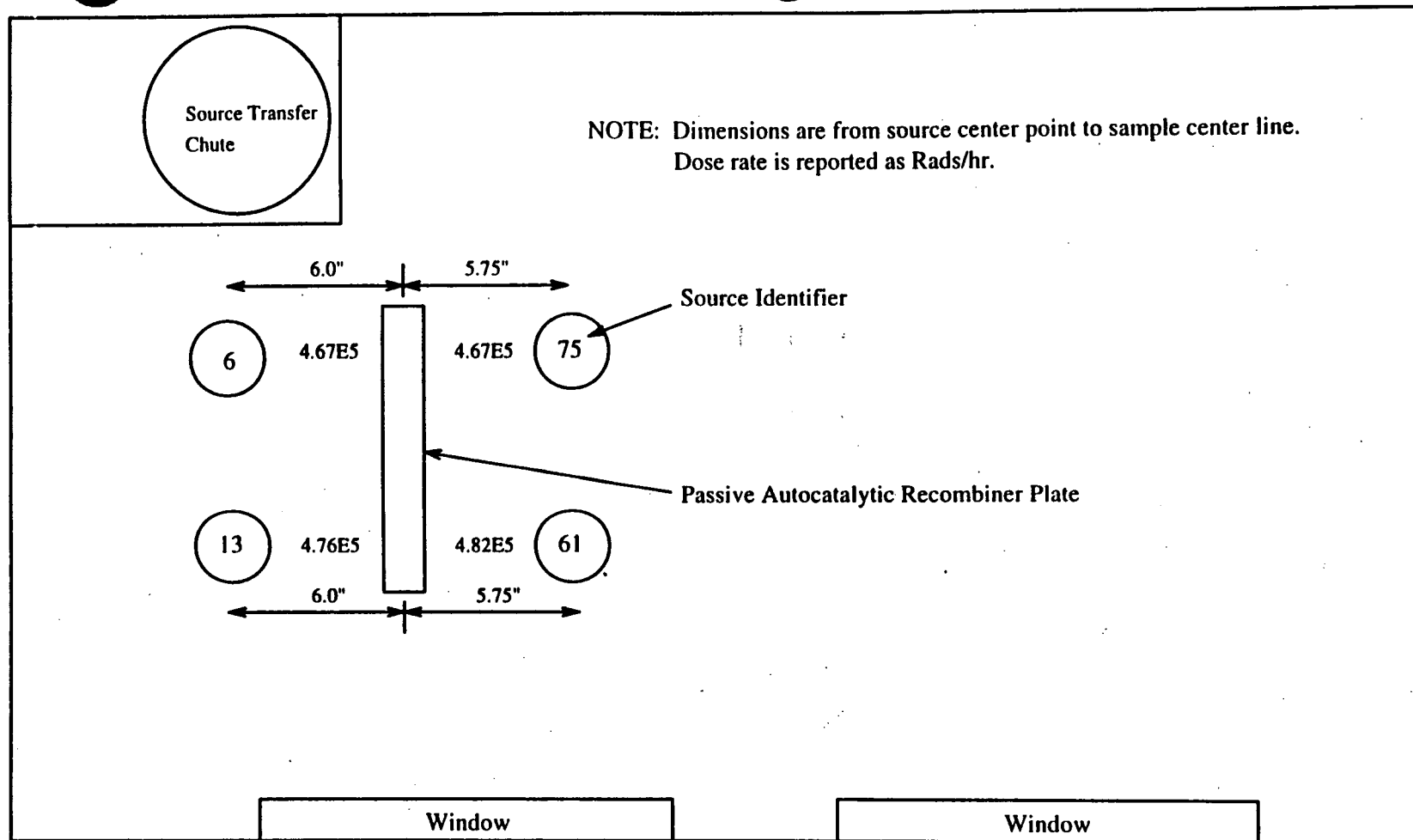
Start	Stop	Elapsed Hours	Dose Rate (Rads/hr)	Dose (Rads)	Cum. Dose (Rads)
03/19/97	03/20/97				
17:20	15:26	22.10	4.73E5	1.04E7	1.04E7

Performed by: *Rita M. York*

Date: 3-20-97

Reviewed by: *Dry P M*

Date: 3-21-97



Georgia Institute of Technology  
Neely Nuclear Research Center  
Hot Cell Operations  
Client: Wyle      Job No.: 97-02

Page No. 26  
Test Report No. 45971-1  
GEORGIA INSTITUTE OF TECHNOLOGY

Frank H. Neely  
Nuclear Research Center  
Atlanta, Georgia 30332  
(404) 894-3605  
Office of Radiological Safety

Client Wyke  
Client Reference Number 4-2188P  
Georgia Tech Reference Number 97-02  
Item(s) Passive Autocatalytic Recombiner Plate

Radioactive Contamination Clearance

G.M. Probe Survey (cpm) <100

Instrument and Serial # Ludlum II 48835 Cal.due 6-19-97

Smearable Contamination (dpm Beta/Gamma) <100

Instrument and Serial # LB5100W Eff. 29.7% Cal.due 11-97

Smearable Contamination (dpm Alpha) <20

Instrument and Serial # LB5100W Eff. 43.1% Cal.due 11-97

Released for Shipment:

[Signature]  
Office of Radiological Safety

3-20-97  
Date

[Signature]  
Hot Cell Operations

3-21-97  
Date



# Georgia Institute of Technology

NEELY NUCLEAR RESEARCH CENTER

900 ATLANTIC DRIVE

ATLANTA, GEORGIA 30332-0425

USA

(404) 894-3600

\*\*\*\*\*  
\*  
\* CERTIFICATE OF CALIBRATION \*  
\* October 30, 1996 \*  
\*  
\* Manufacturer: LND PROBE \*  
\* Model: 52120 \*  
\* Description: Probe \*  
\* Serial No.: NNRC-106 \*  
\* Calibrated By: Georgia Institute of Technology \*  
\* Neely Nuclear Research Center \*  
\* Atlanta, GA 30332 \*  
\*  
\* Calibration Due 07/21/97  $\pm$  25% \*  
\*  
\* This Certificate attests that this instrument has been \*  
\* calibrated with standards traceable to the National \*  
\* Institute of Standards and Technology. \*  
\*  
\* NIST Traceability \*  
\*  
\* Reference Test: 536/247012-90 \*  
\* XRG - 726 \*  
\* NIST DB 108/065 \*  
\*  
\*\*\*\*\*



# Georgia Institute of Technology

NEELY NUCLEAR RESEARCH CENTER  
900 ATLANTIC DRIVE  
ATLANTA, GEORGIA 30332-0425  
USA

(404) 894-3600

## CERTIFICATE OF CALIBRATION

December 9, 1996

Manufacturer: KEITHLEY  
Model: 485  
Description: Autoranging Picoammeter  
Serial No.: 375586  
Calibrated By: Georgia Institute of Technology  
Neely Nuclear Research Center  
Atlanta, GA 30332

Calibration Due 12/28/97  $\pm$  25%

This Certificate attests that this instrument has been calibrated with standards traceable to the National Institute of Standards and Technology.

## STANDARDS USED IN CALIBRATION

Keithley Picoampere Source, Model No. 263, SN 0558088  
Calibrated: November 11, 1996 Due 10/17/97  $\pm$  25%  
Calibrated by: Simco Electronics  
8601 Dunwoody Place  
Suite 342  
Atlanta, GA 30350

### Traceability:

ID#	MFG	MDL#	DESCRIPTION	DUE CAL
16588	DATRON	1281	DMM	08/05/97
04534	ESI	SR1010	Resistance Transfer Std	09/08/97
03070	ESI	SR1010	Res Standard	09/08/97
13015	ESI	SR1010	Std Resistor	09/08/97
15540	ESI	SR1	Std Resistor 10 MEGOHM	11/05/97
18727X	AEL	HI-MEG	Resistance Box	04/04/97

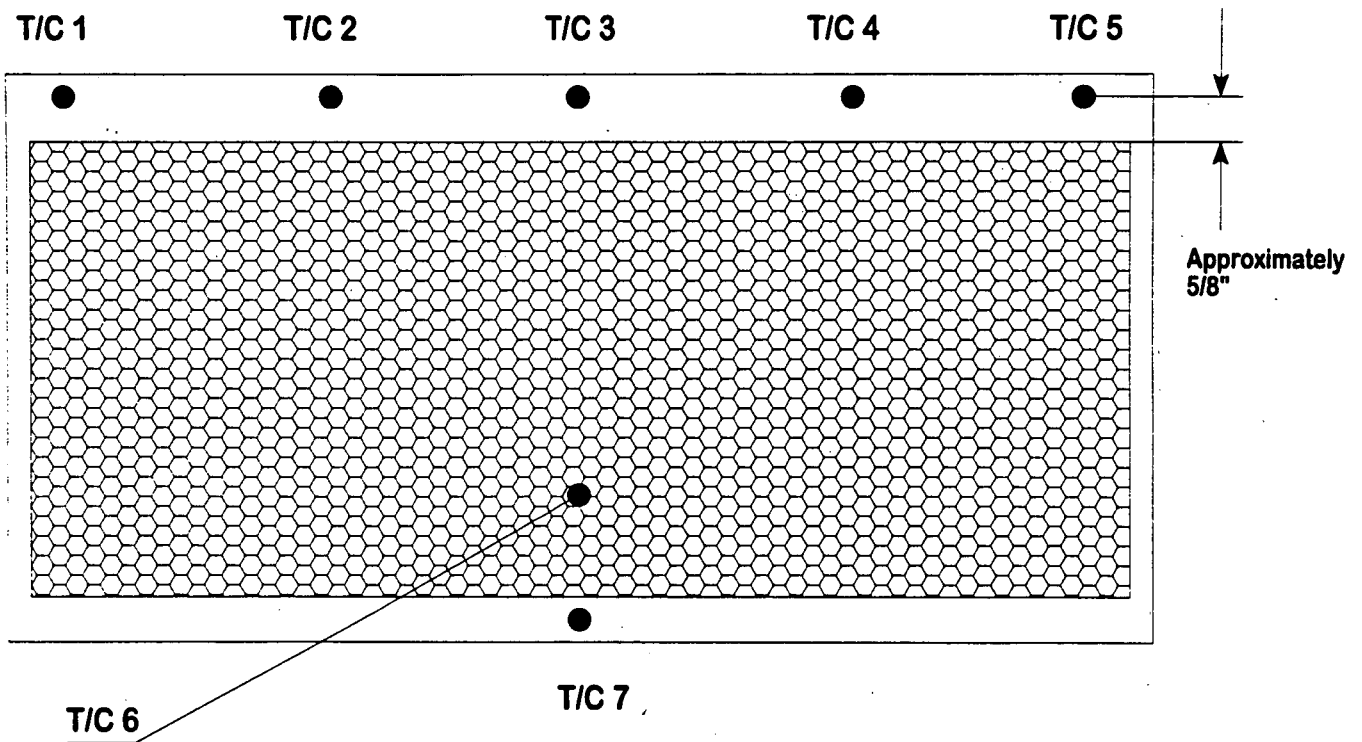
PARAMETER	NIST NUMBERS
Ratio	Ratio
Resistance	811/255094
DC Volts	Fluke Josephson Array System

**APPENDIX IV**

**HYDROGEN EXPOSURE TEST PLOTS AND THERMOCOUPLE PLACEMENT**

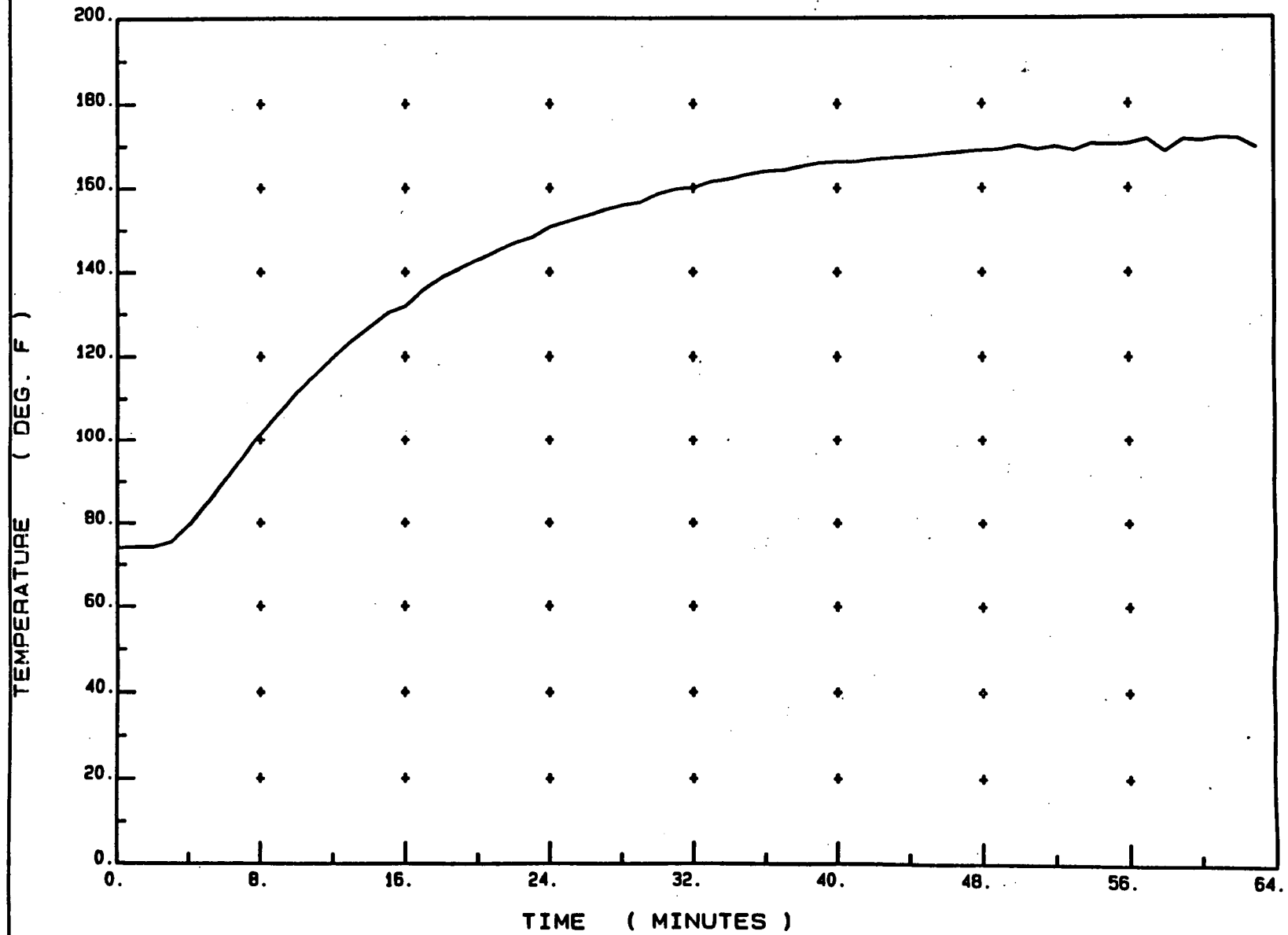
**This page intentionally left blank.**

## Thermocouple Placement



CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

T/C#1

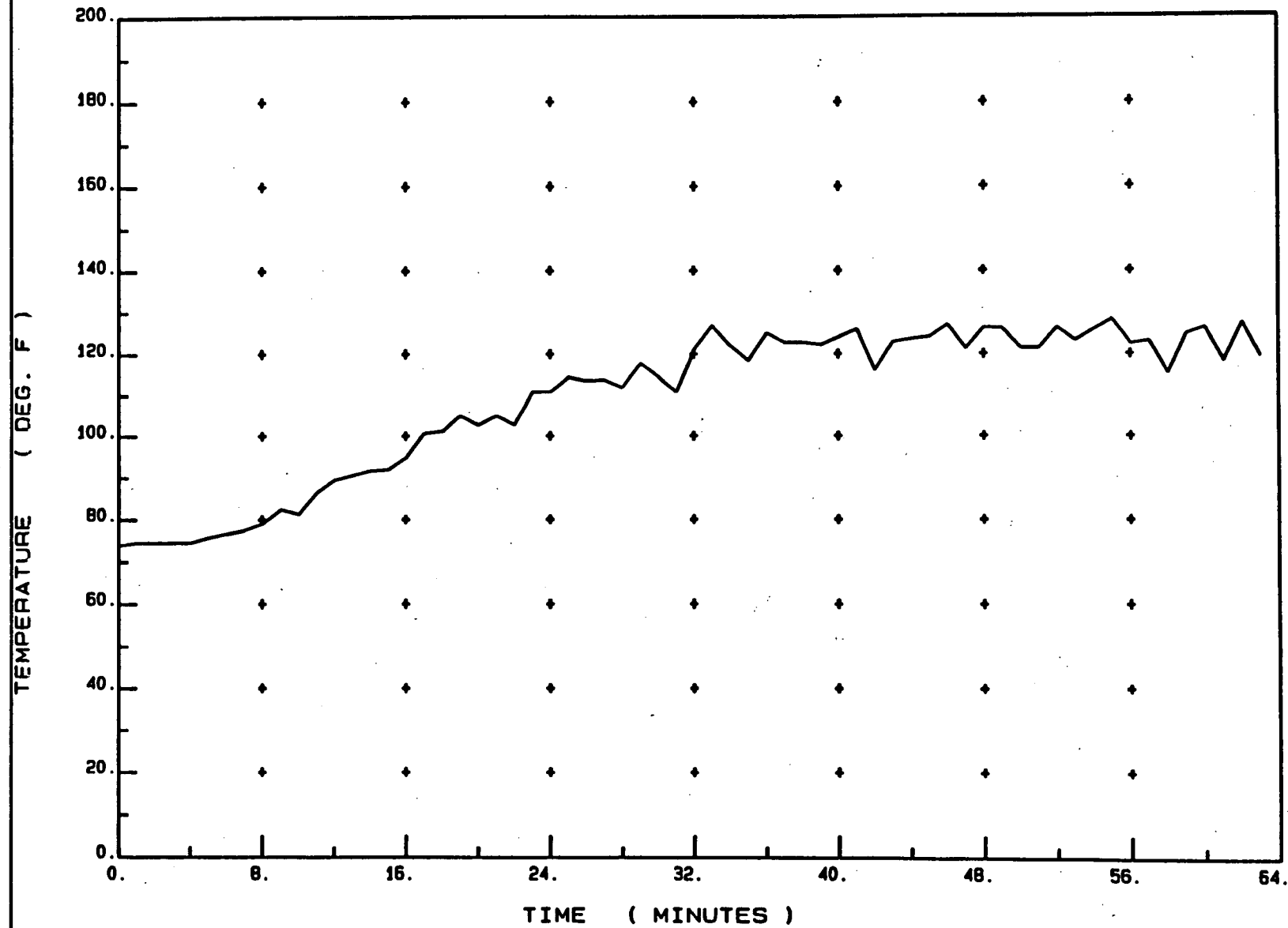


/log/data/CON-EDDRY/950314103437.975

wyle

CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

T/C#2

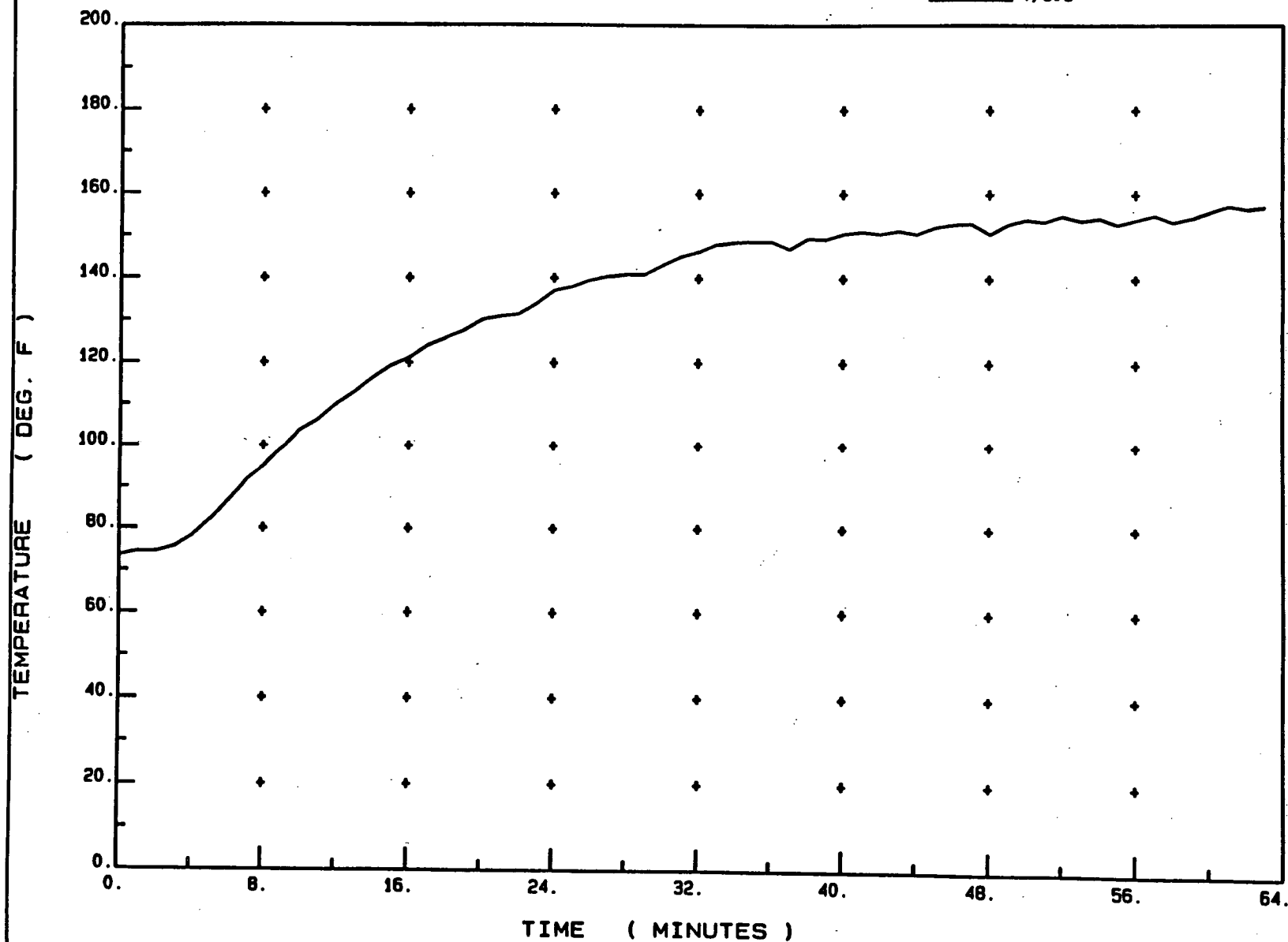


/log/data/CON-EDRY/950314103437.975

wyle

CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

T/C#3

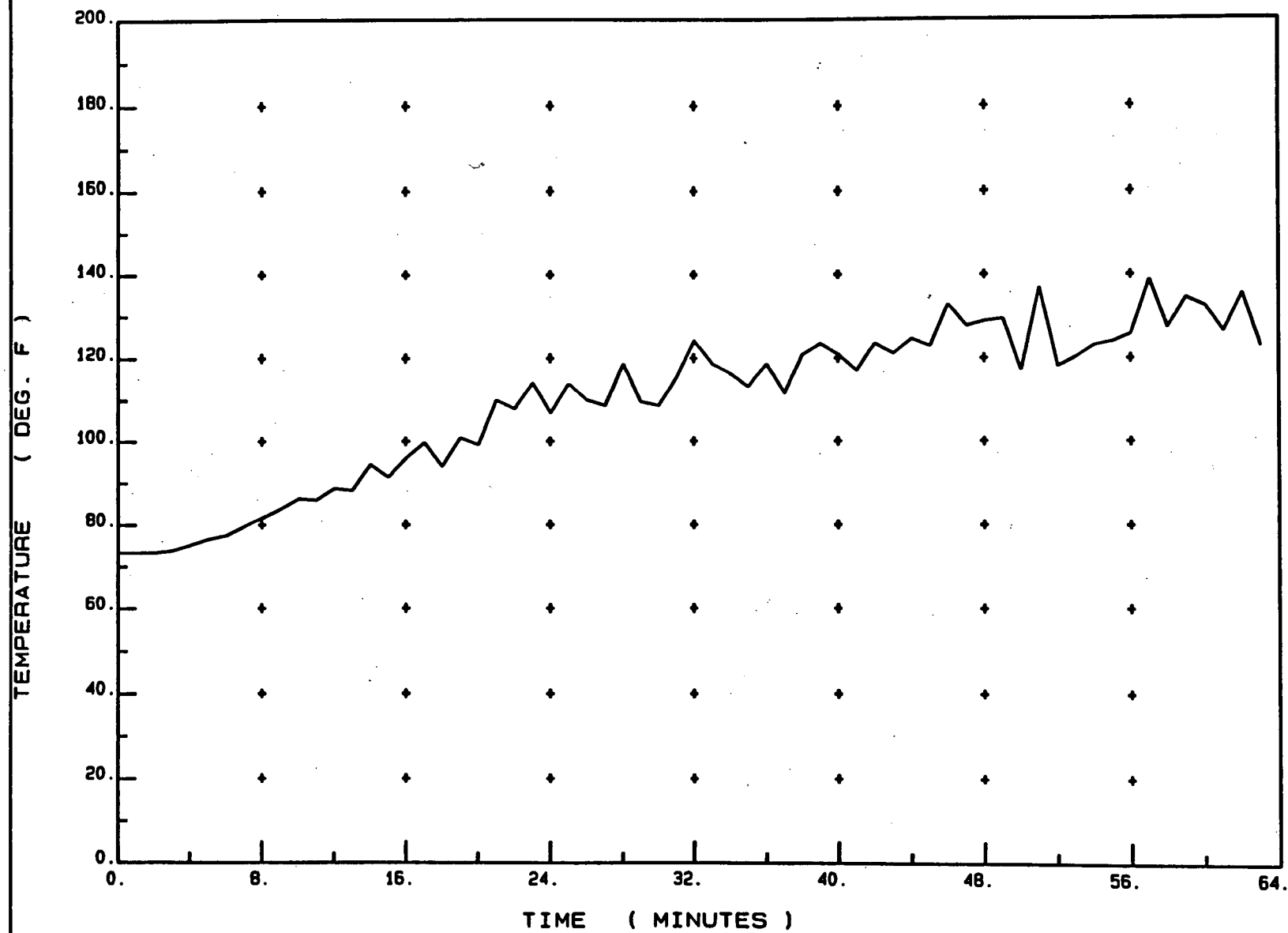


/log/data/CON-EDORY/950314103437.975

wyle

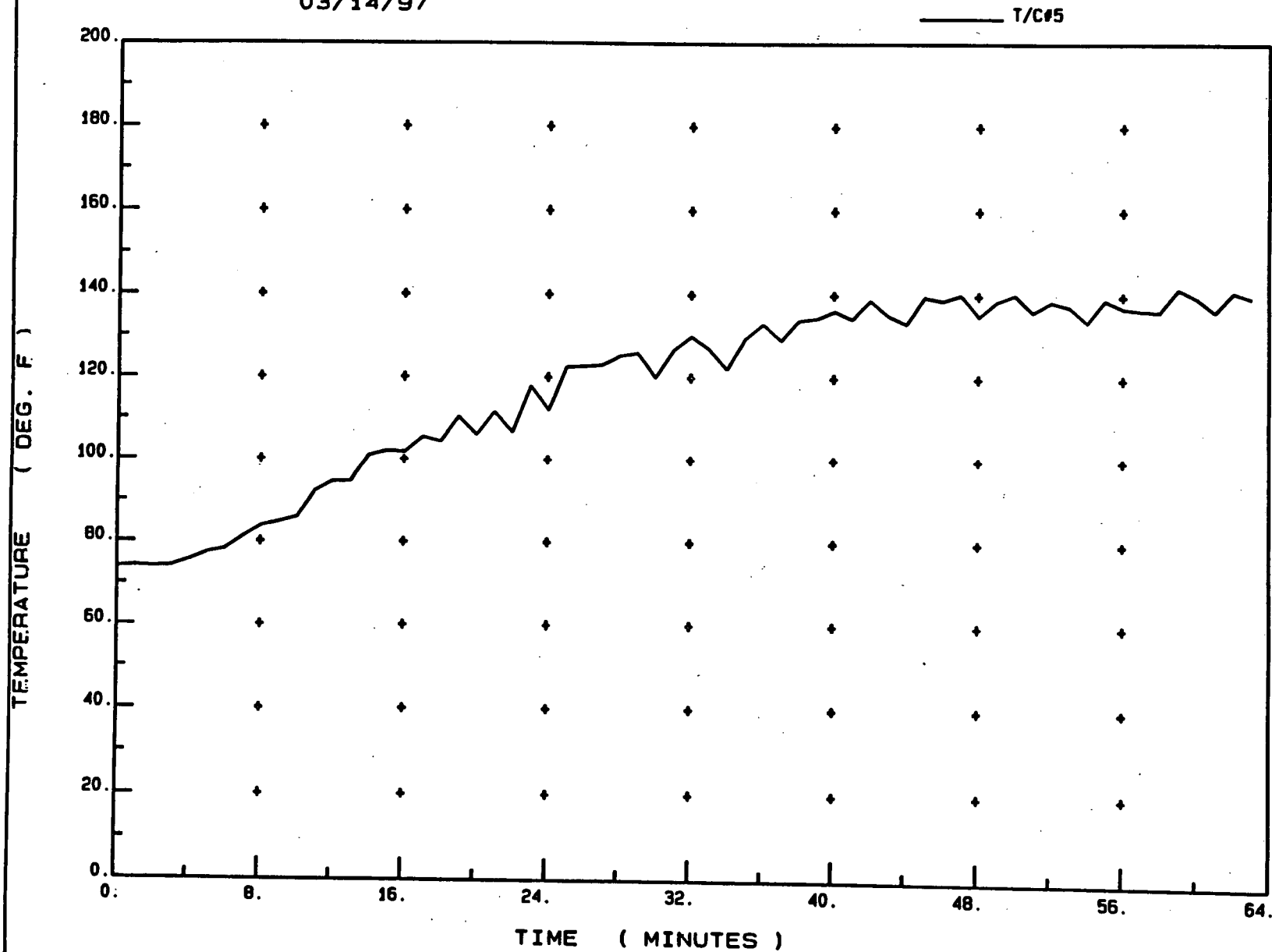
CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

T/C#4



wyle

CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

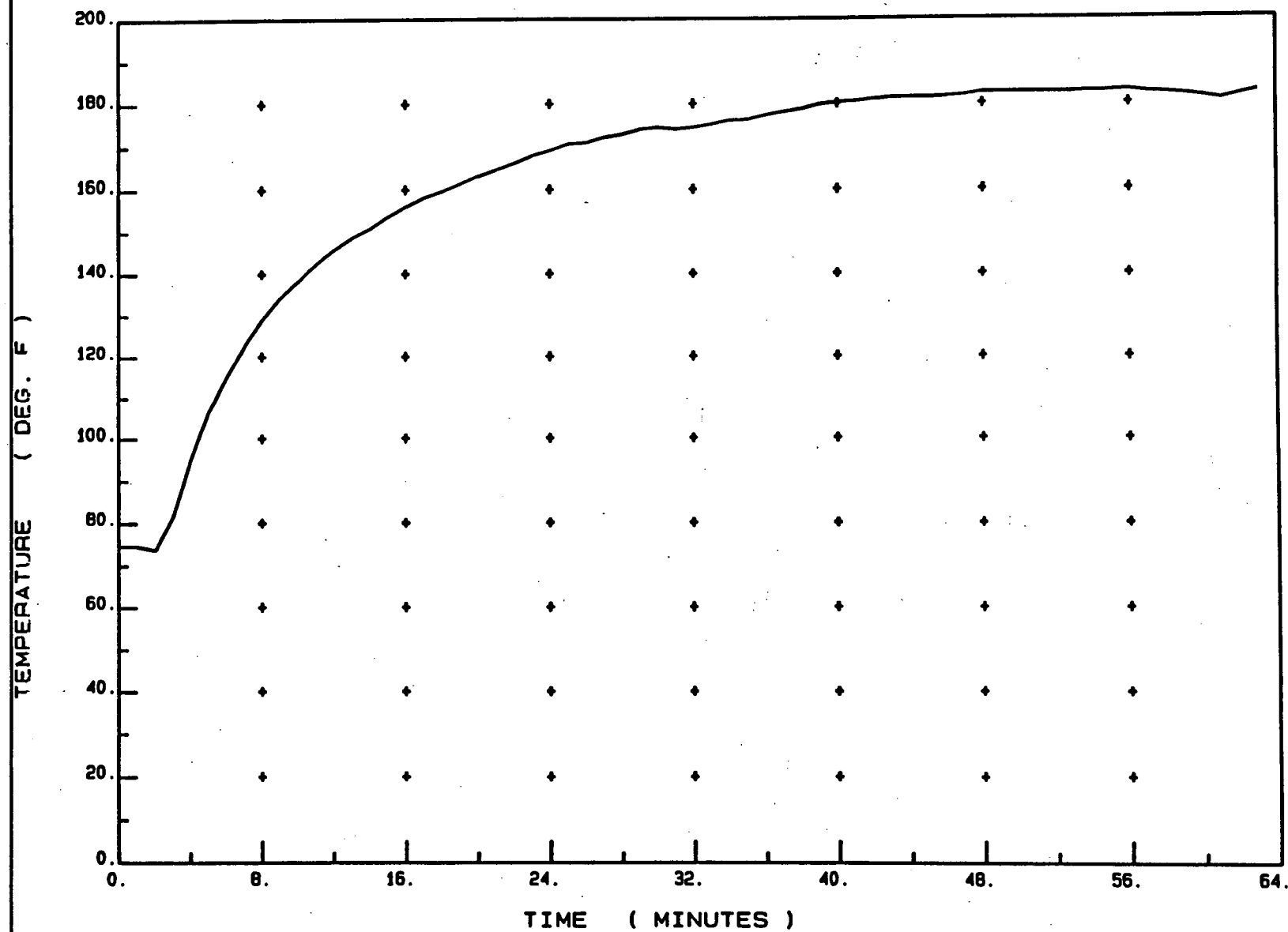


7:\log\data\CON-EDDRY\950314103437.975

wyle

CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

T/C#6

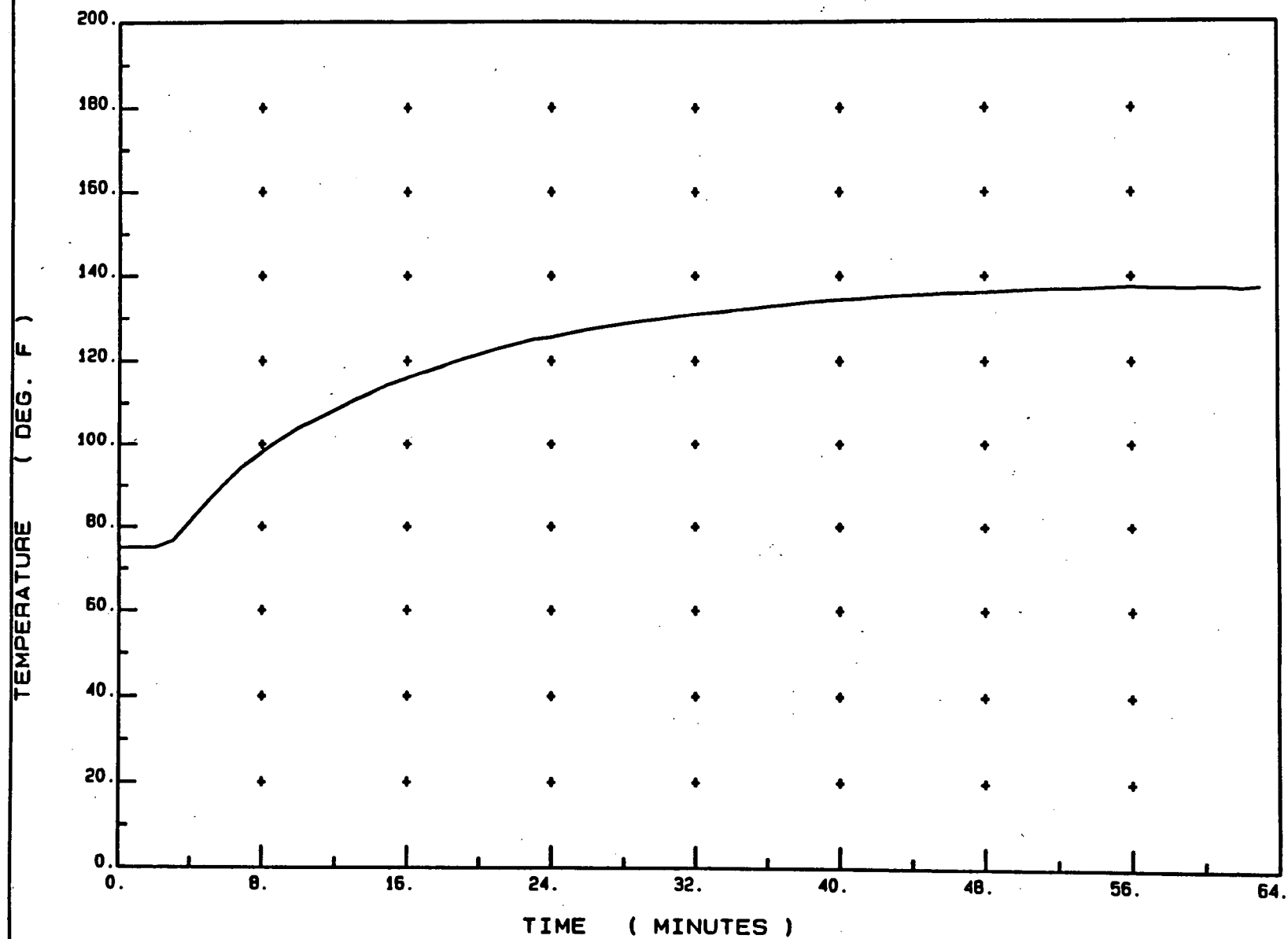


wyle

/loc/data/CON-EDORY/950314103437.975

CON. ED. 45971-00  
HYDROGEN TEST DRY  
03/14/97

—— T/C#7

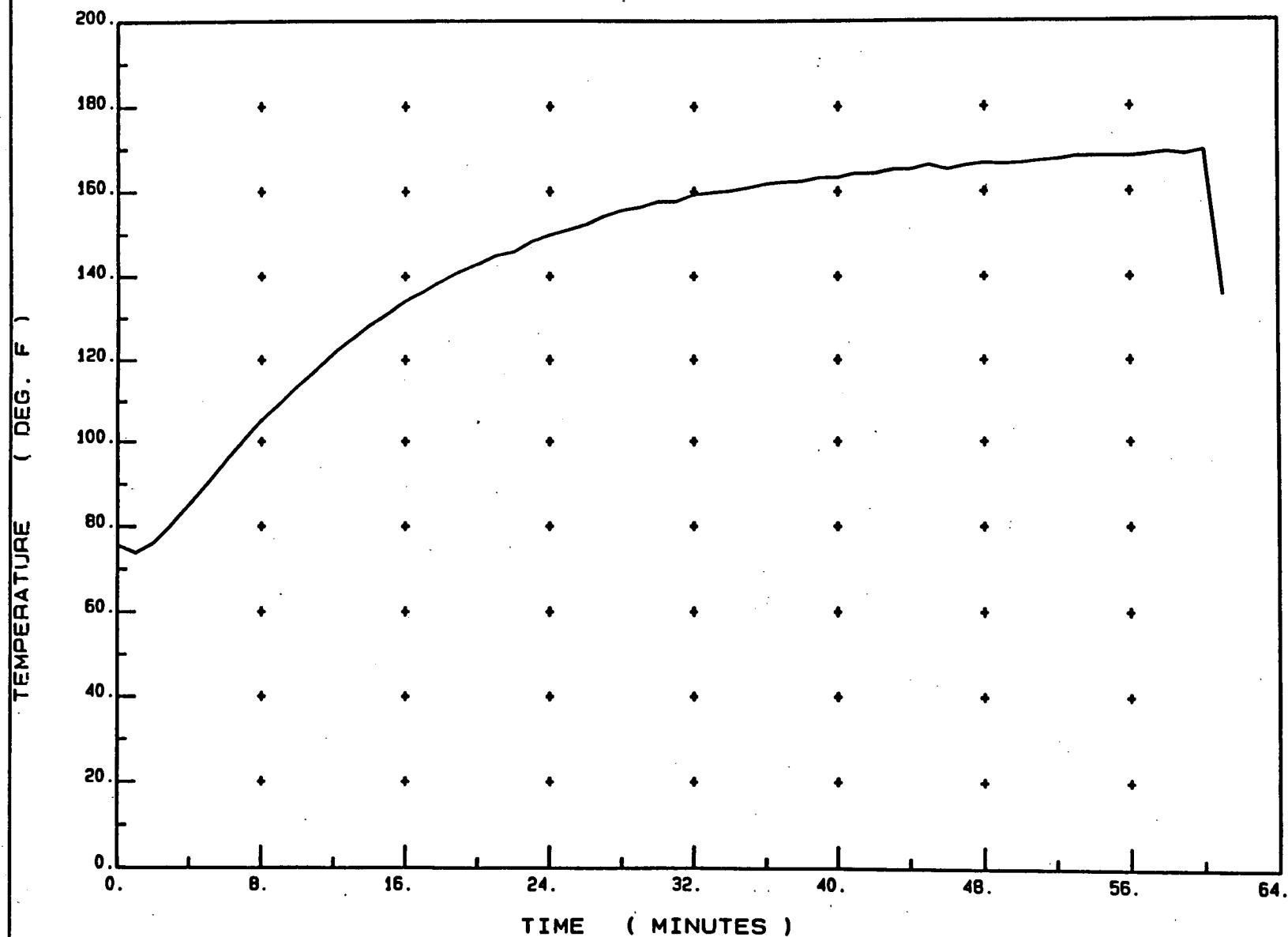


wyle

/100/data/CON-ED00RY/950314103437.975

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

T/C#1

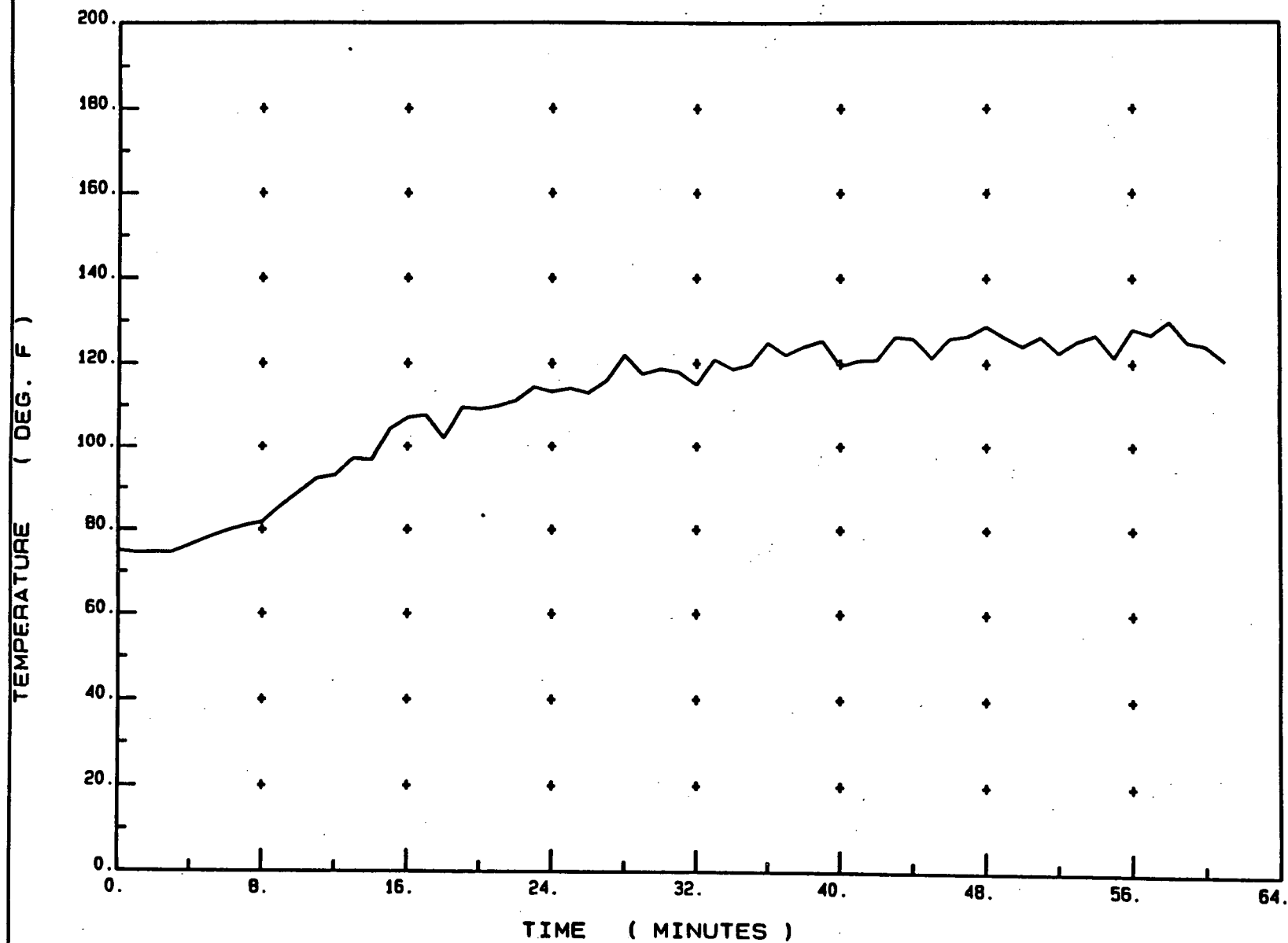


/10q/data/TEST1/950314132102.695

wyle

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

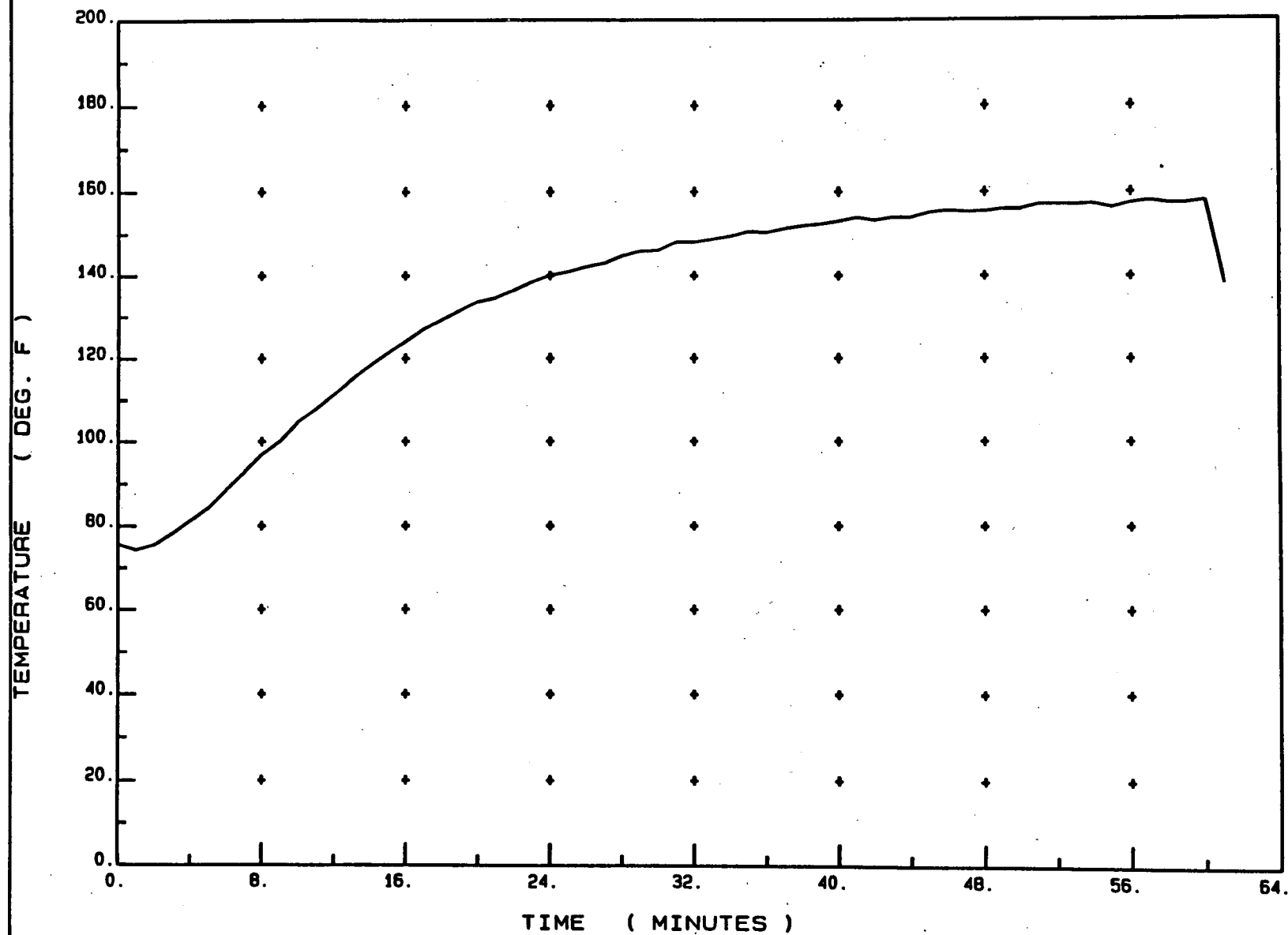
T/C#2



wyle

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

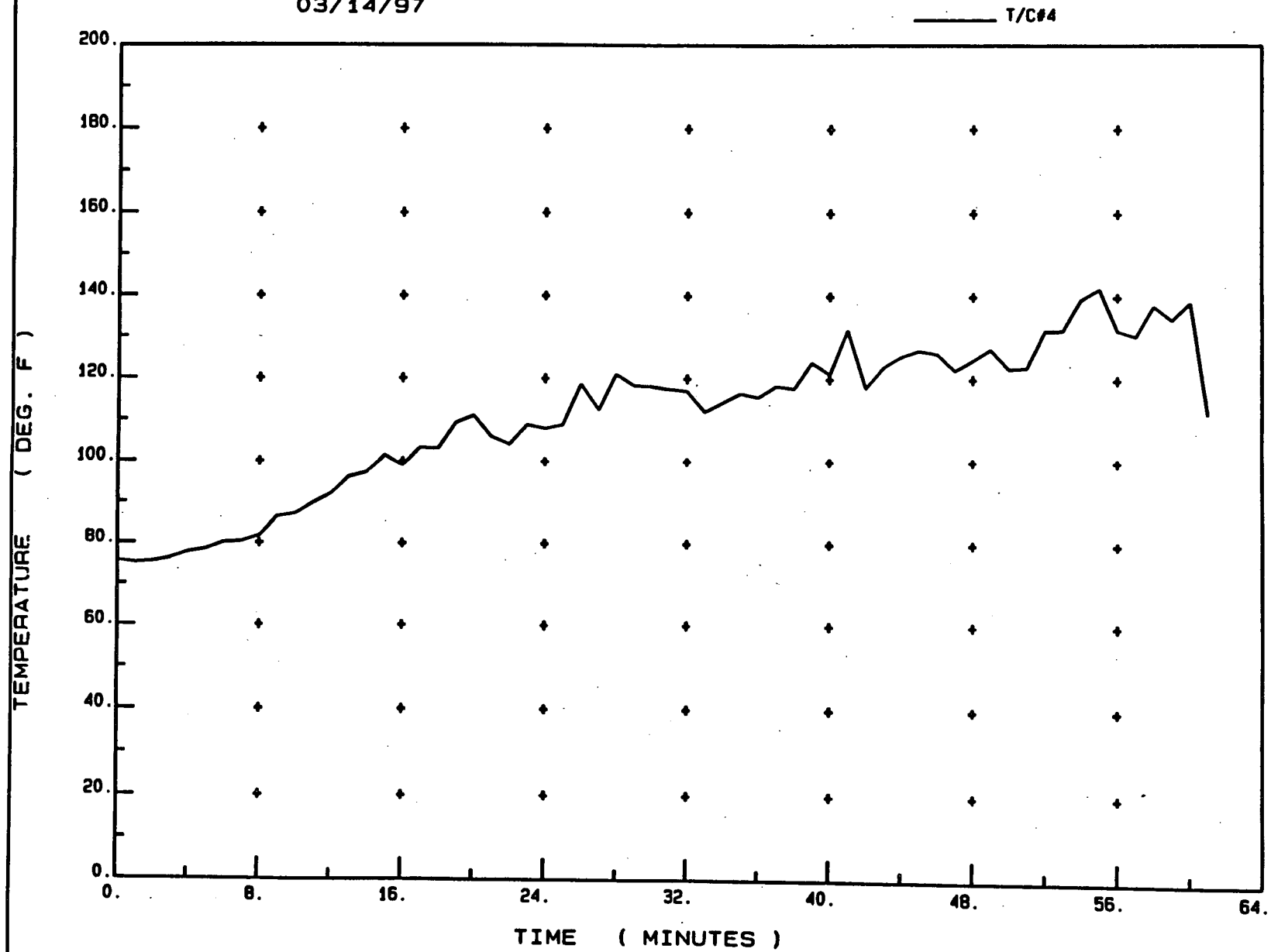
T/C#3



/100/data/TEST1/950314132102.695

wyle

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

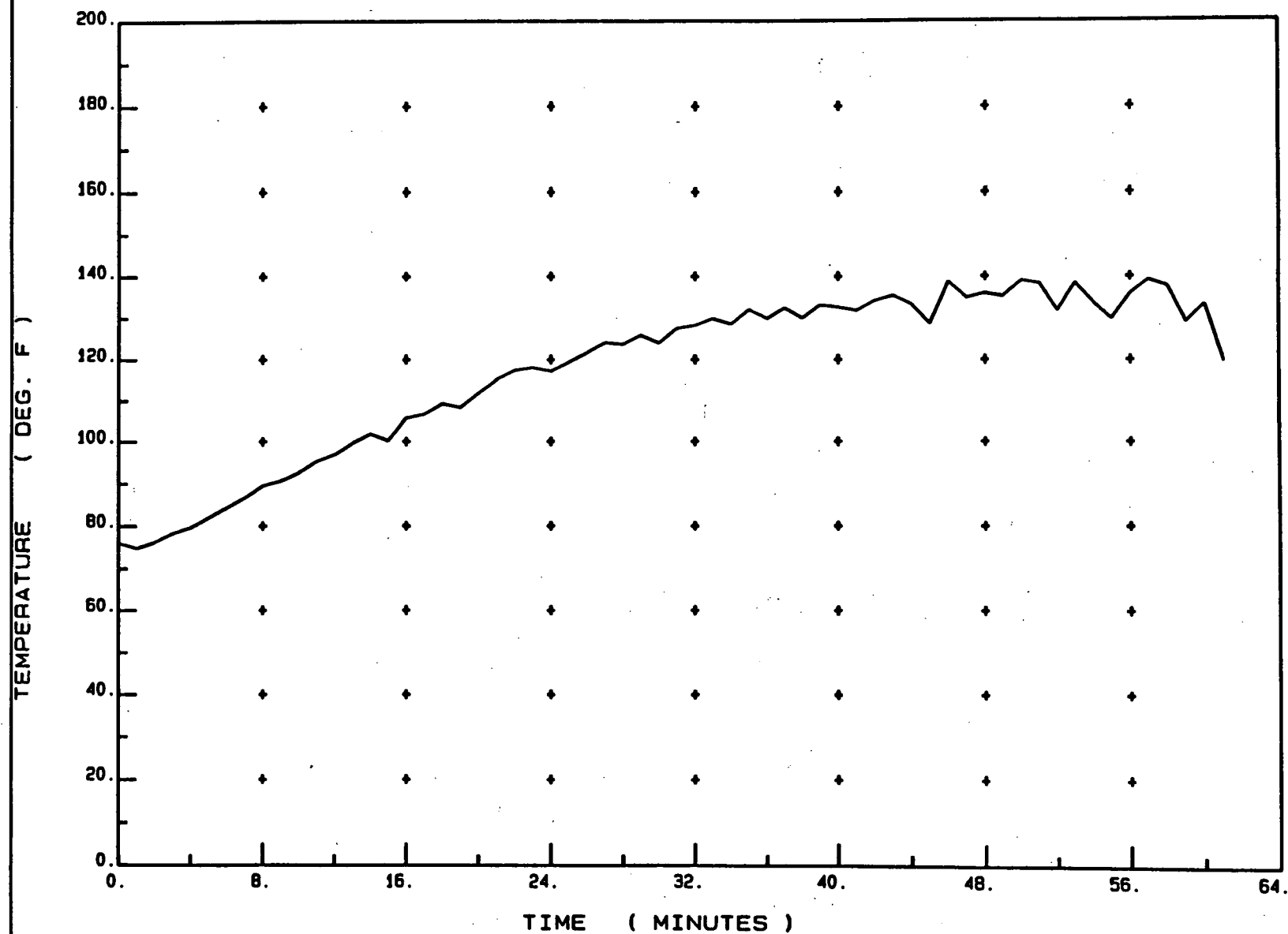


/log/data/TEST1/950314132102.695

wyle

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

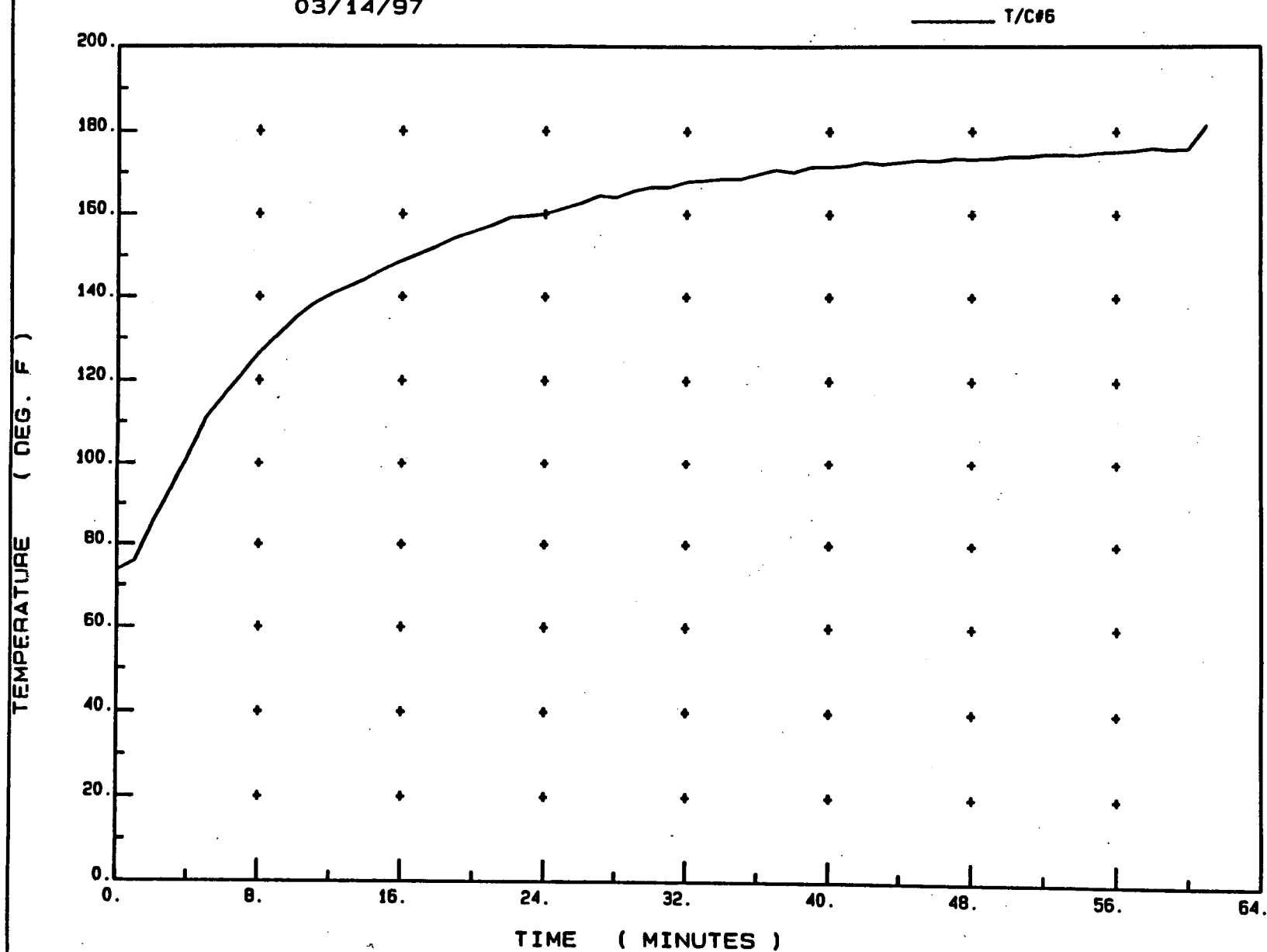
T/C#5



/100/data/TEST1/950314132102.695

wyle

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

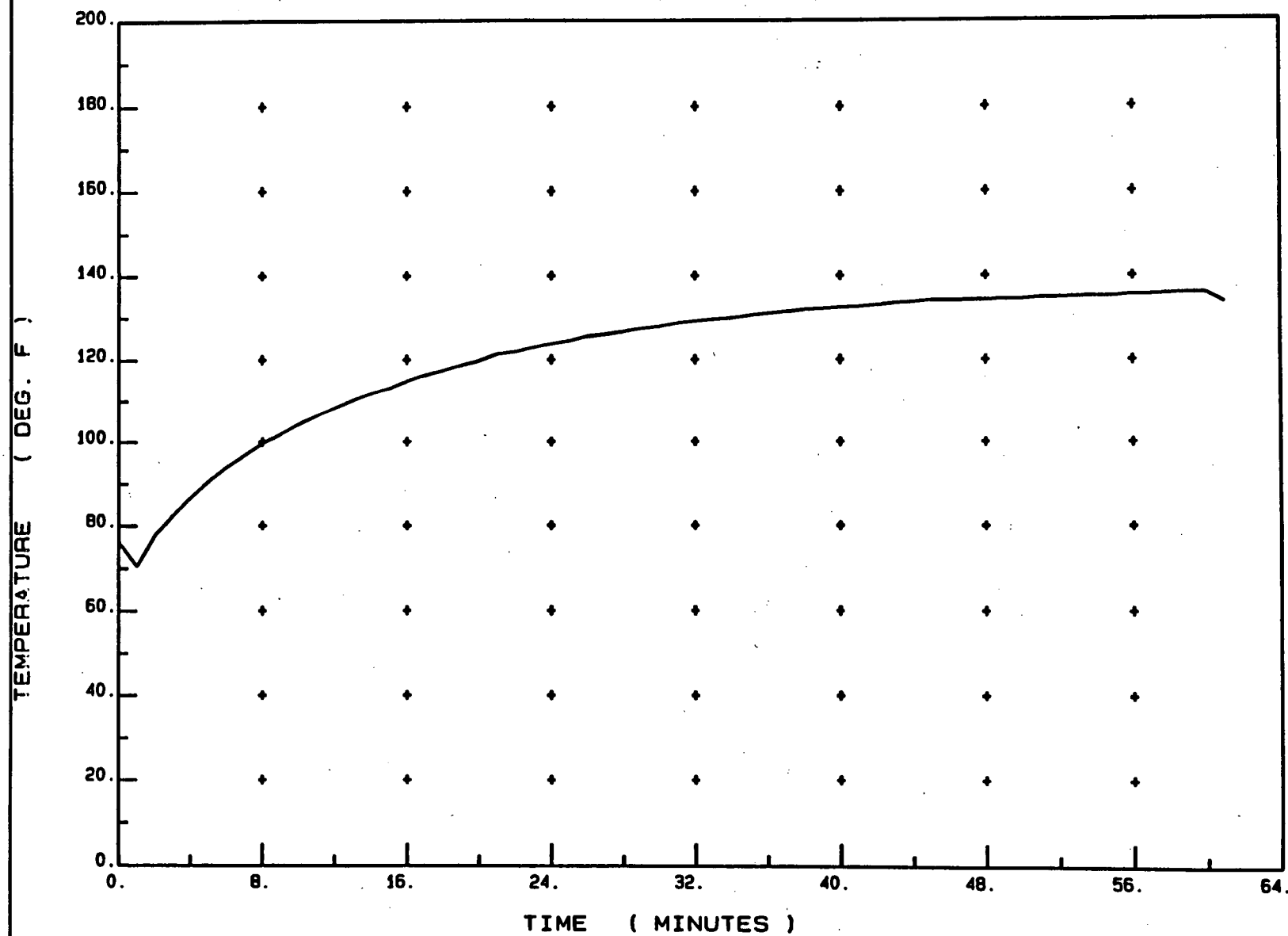


/log/data/TEST1/950314132102.695

wyle

CON. ED. 45971-00  
HYDROGEN TEST WET  
03/14/97

T/C#7

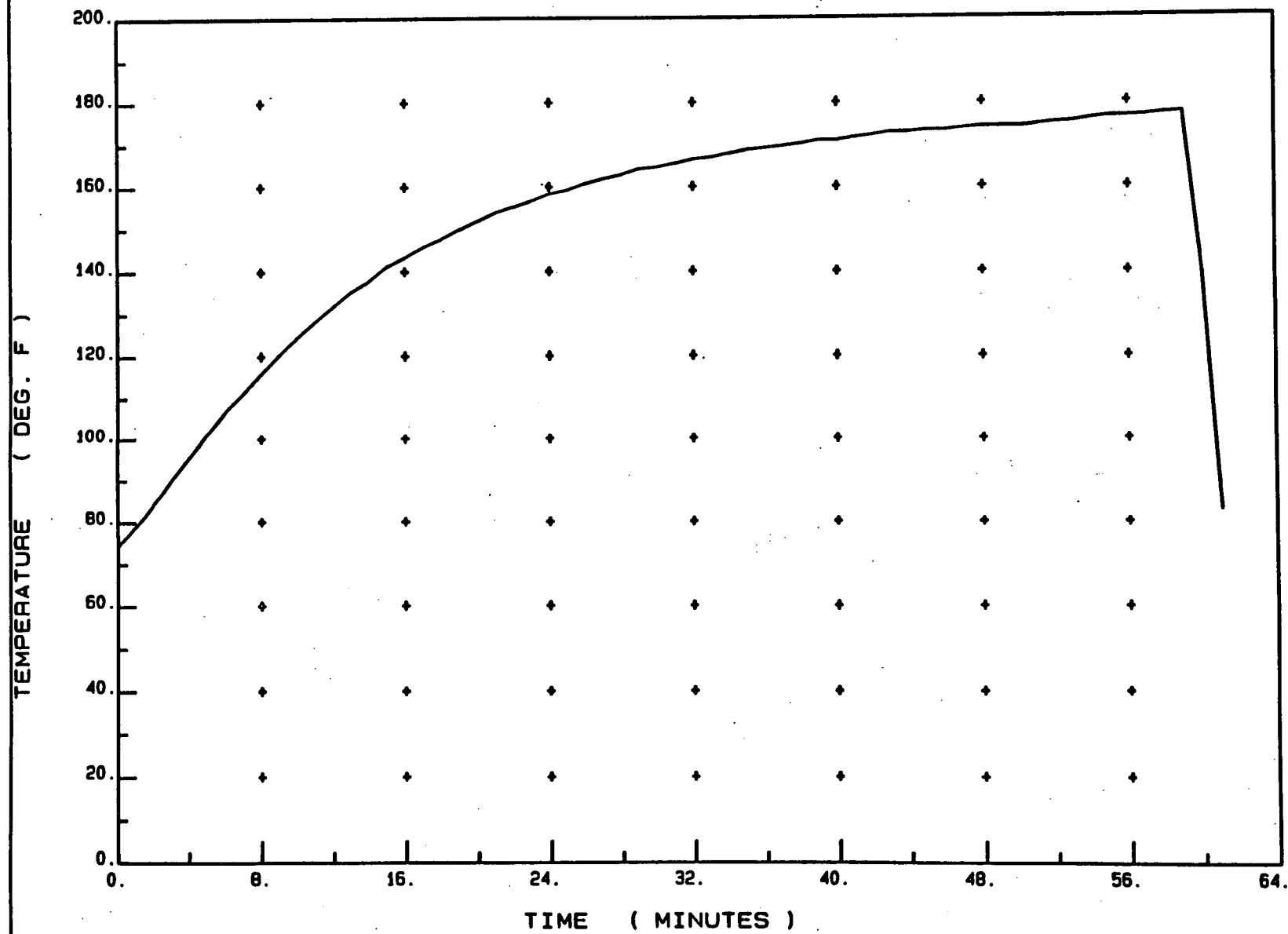


/100/data/TEST1/950314132102.695

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#1

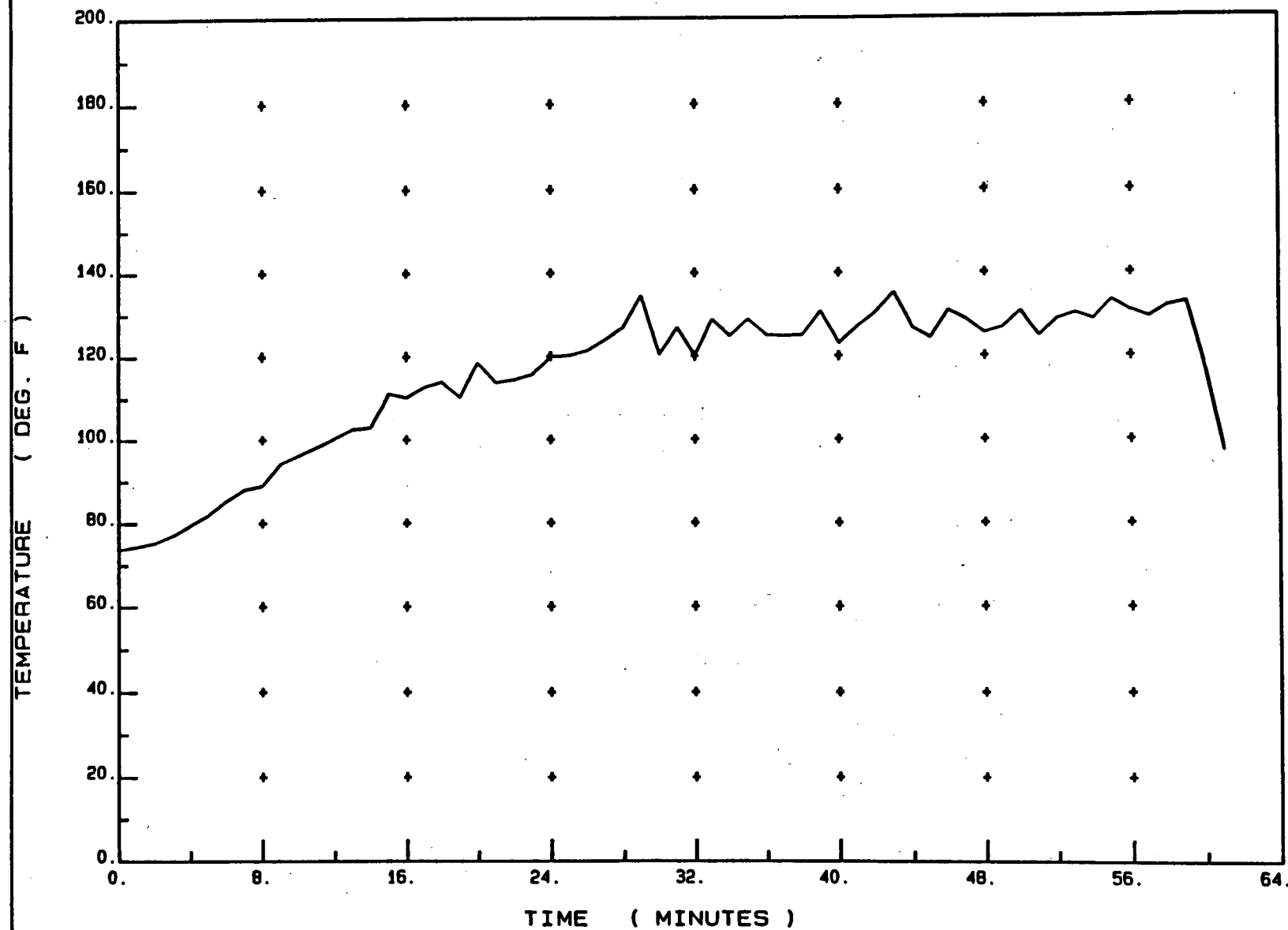


wyle

/log/data/TEST1/950328125636.960

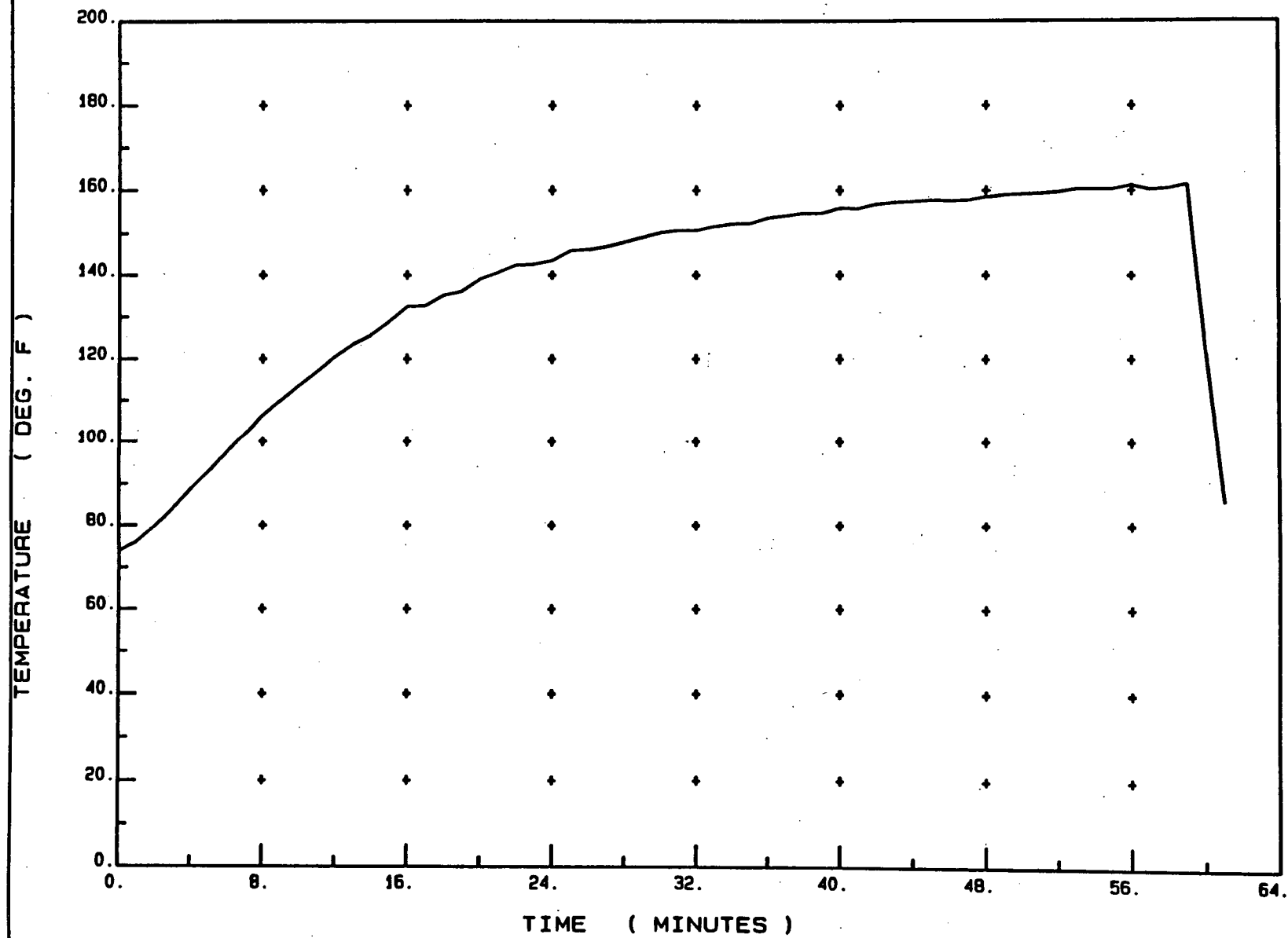
CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#2



CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#3

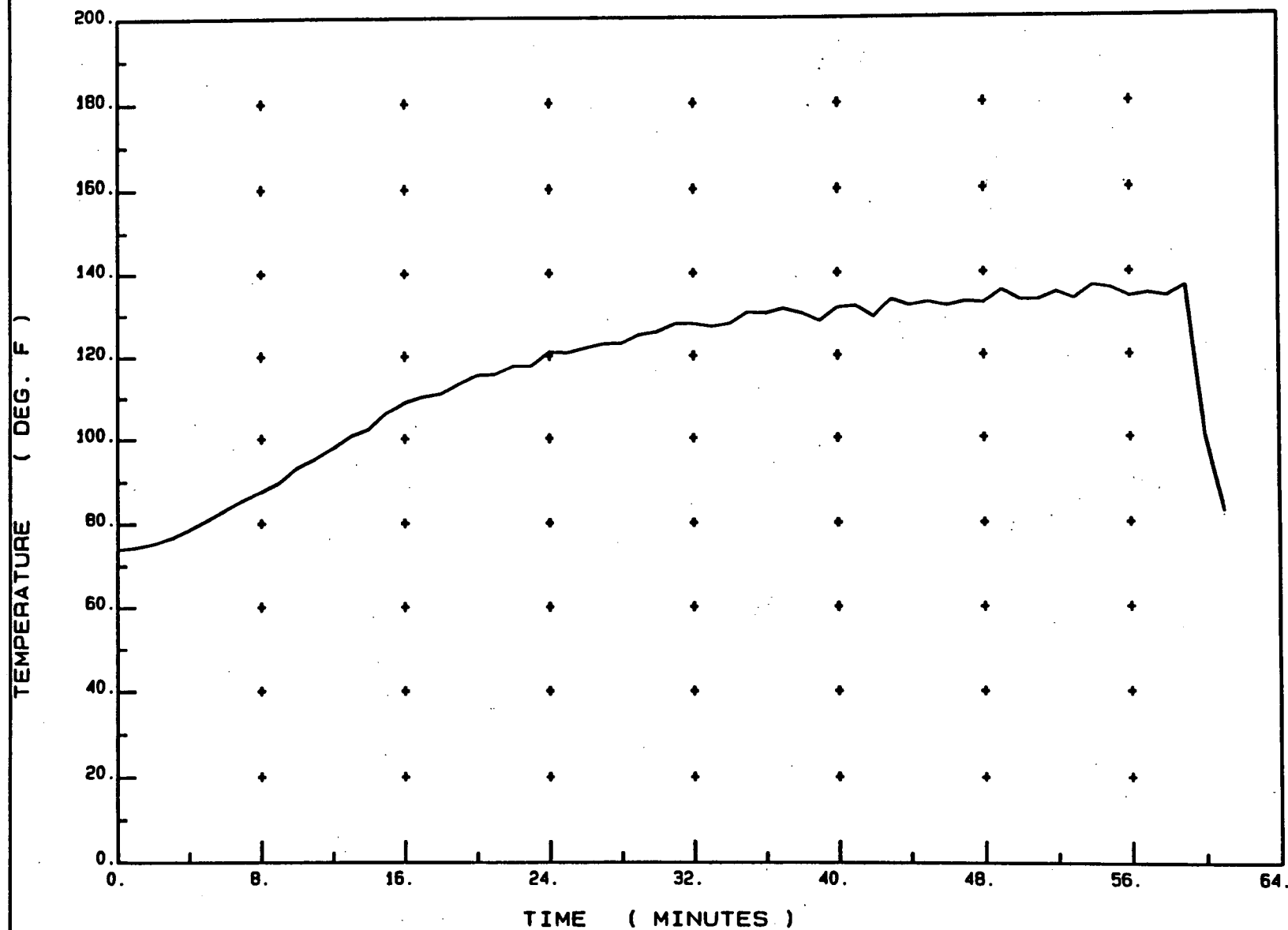


/ioq/data/TEST1/950328125636.960

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#4

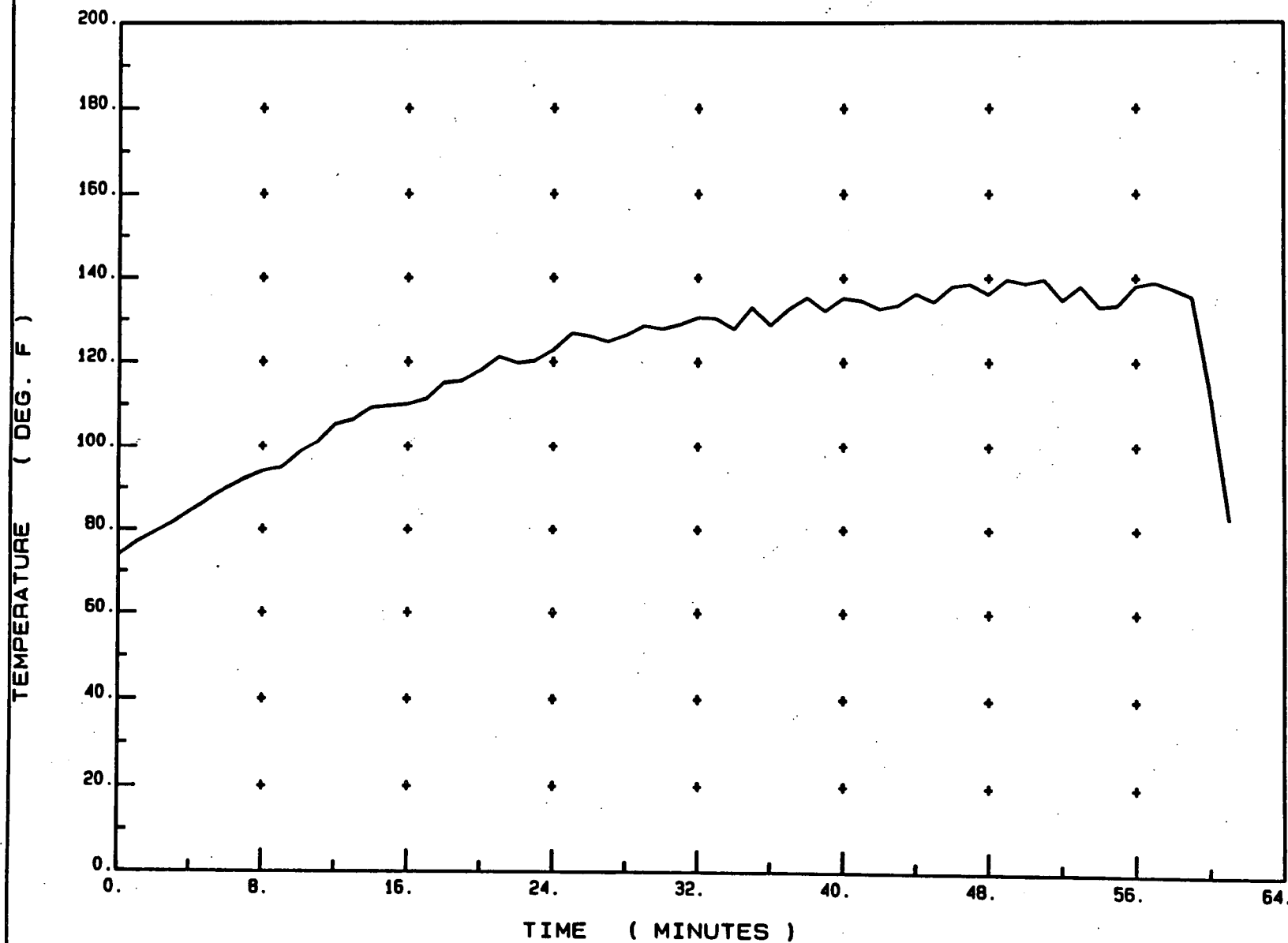


/ioq/data/TEST1/950328125636.960

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#5

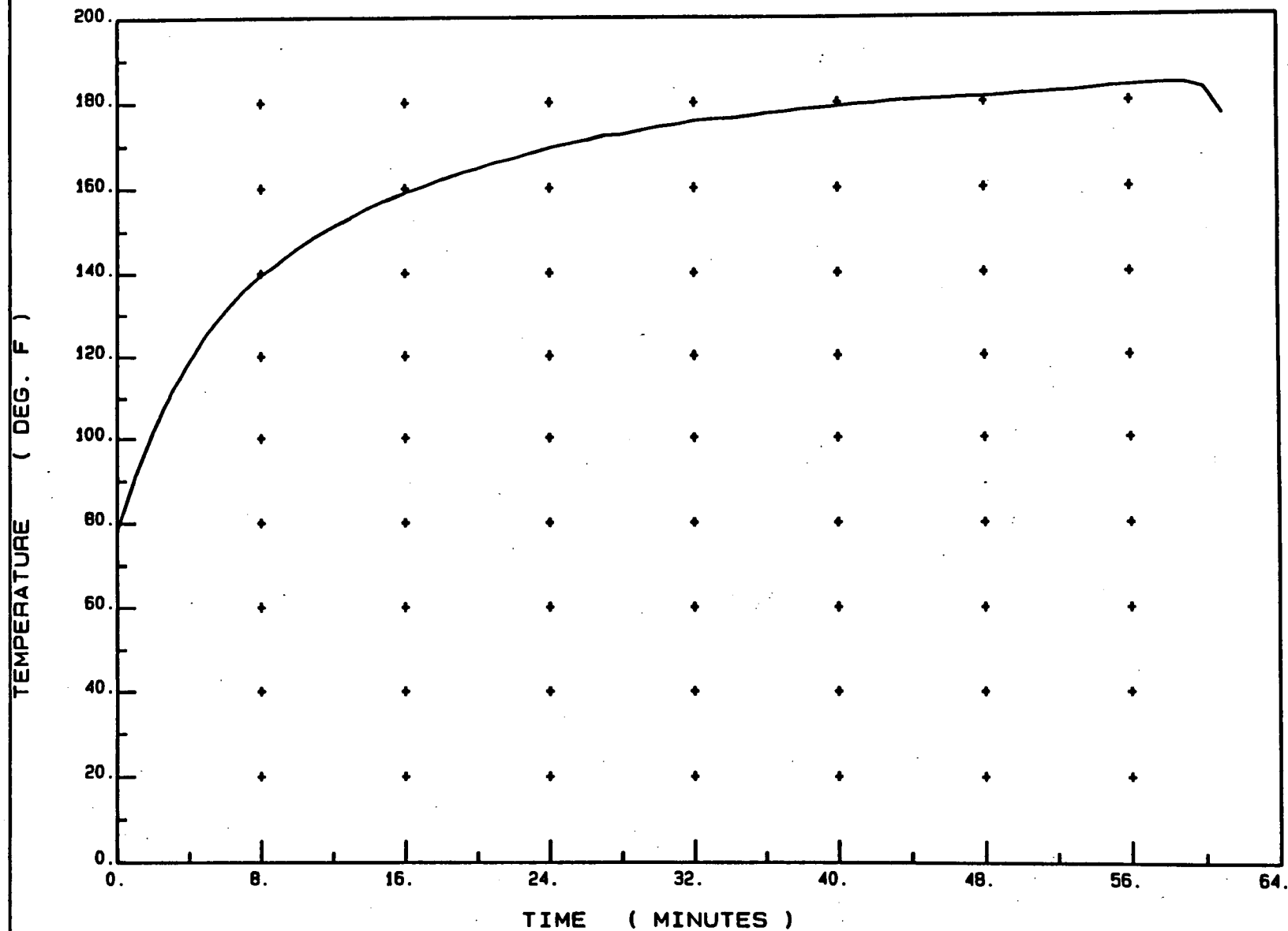


/log/data/TEST1/950328125636.960

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#6

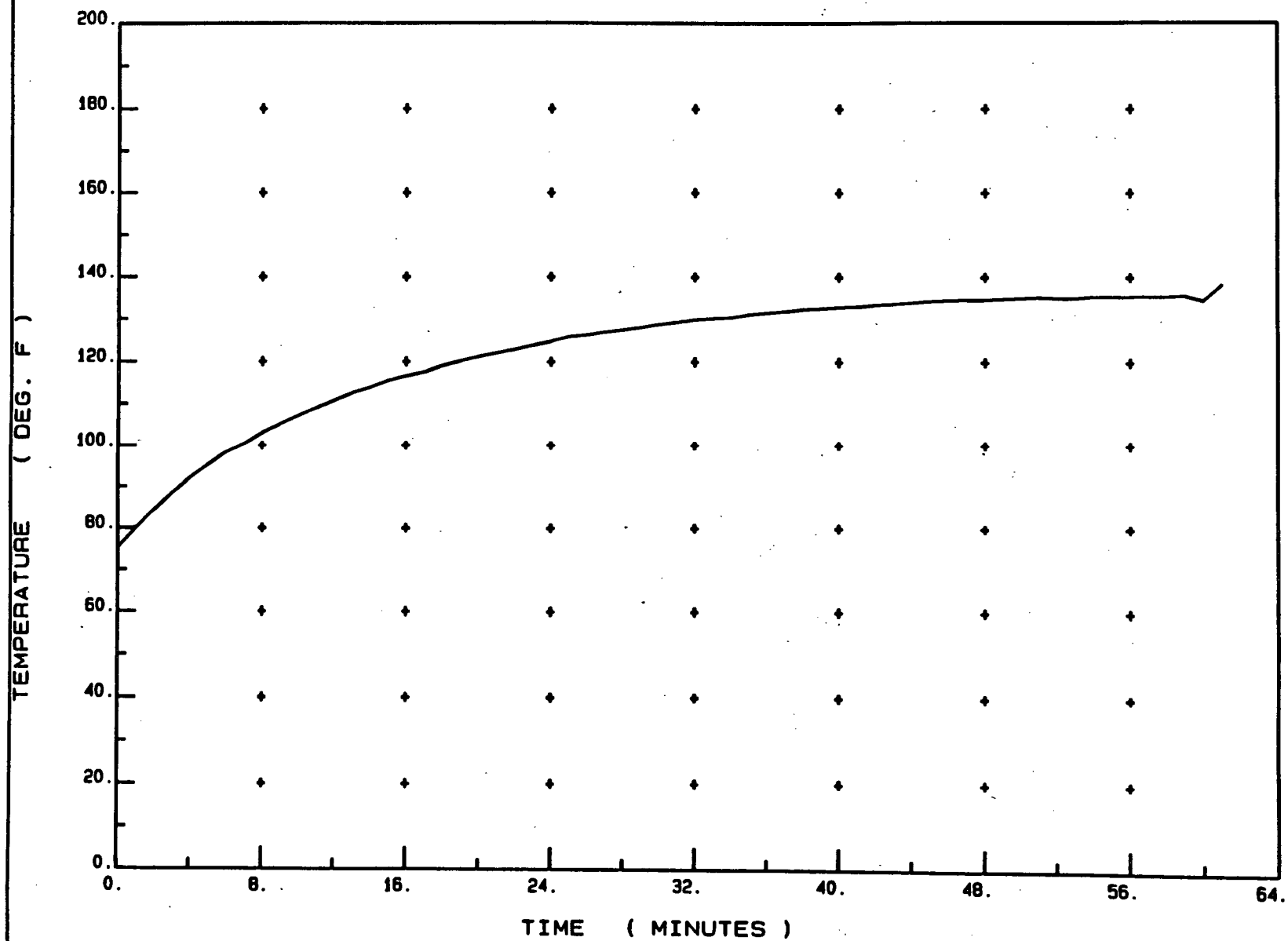


7\log\data\TEST1\950328125636.960

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST DRY  
03/28/97

T/C#7

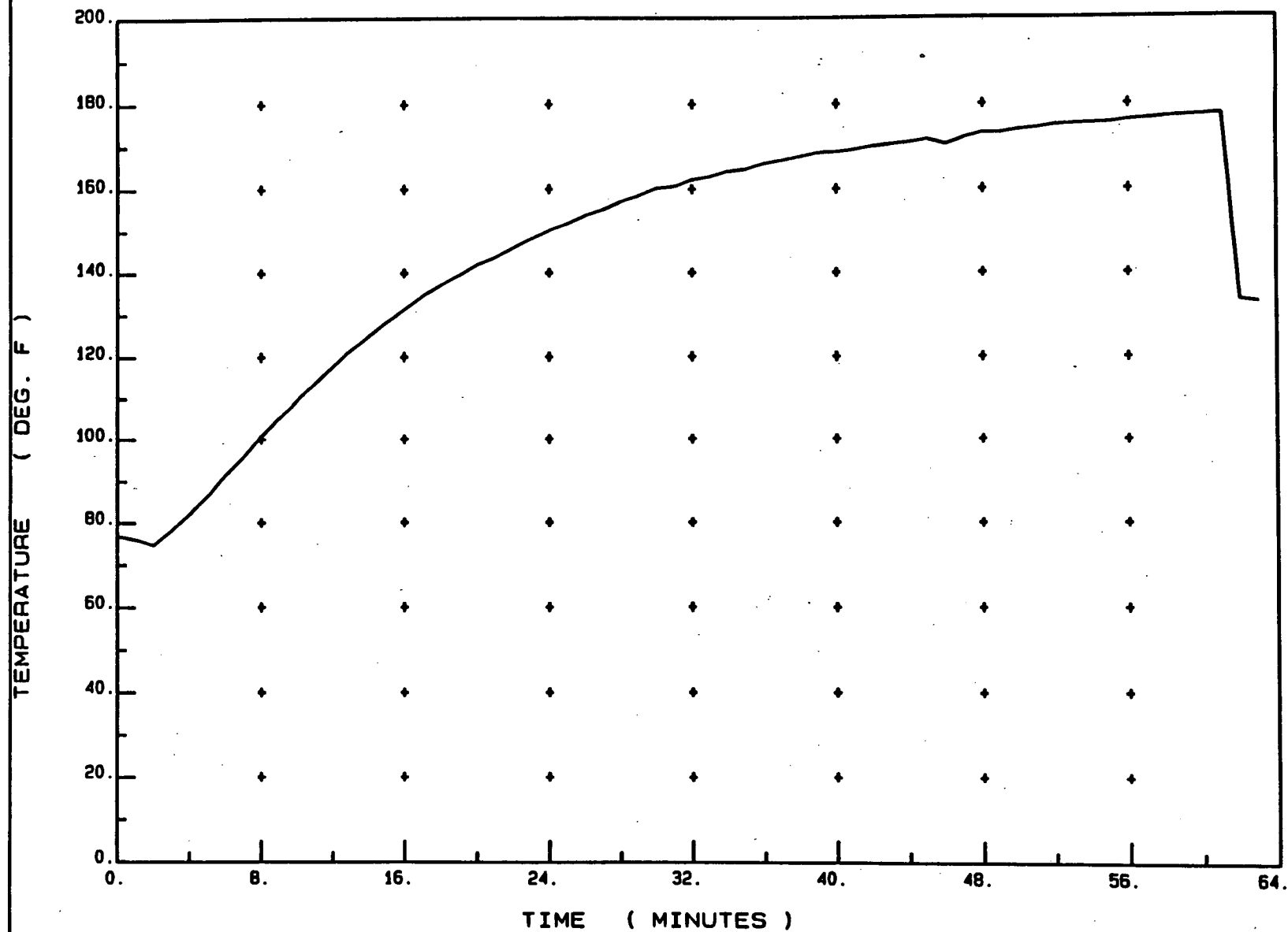


/log/data/TEST1/950328125636.960

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

T/C#1

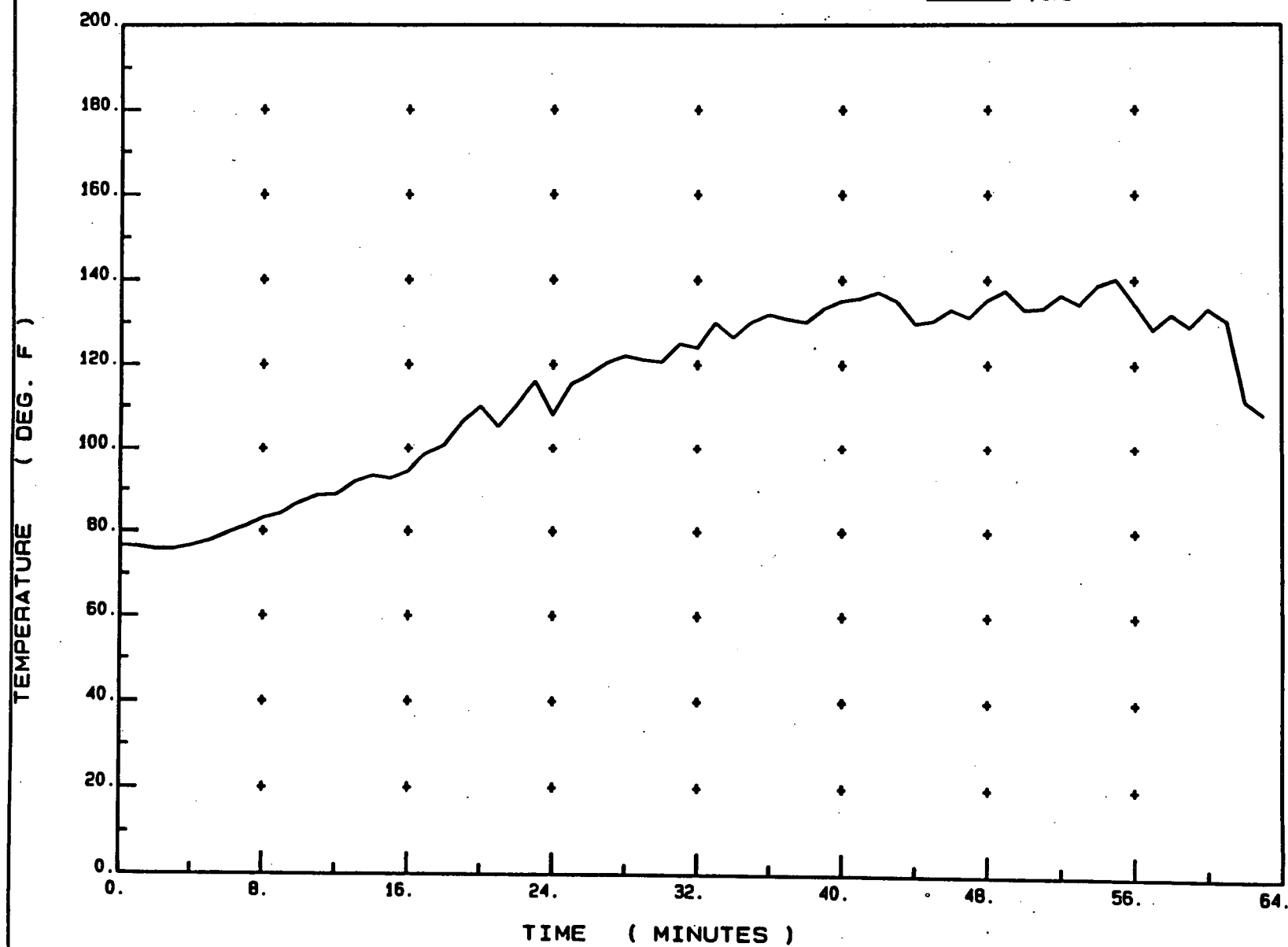


/log/data/TEST1/950328153828.495

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

— T/C#2

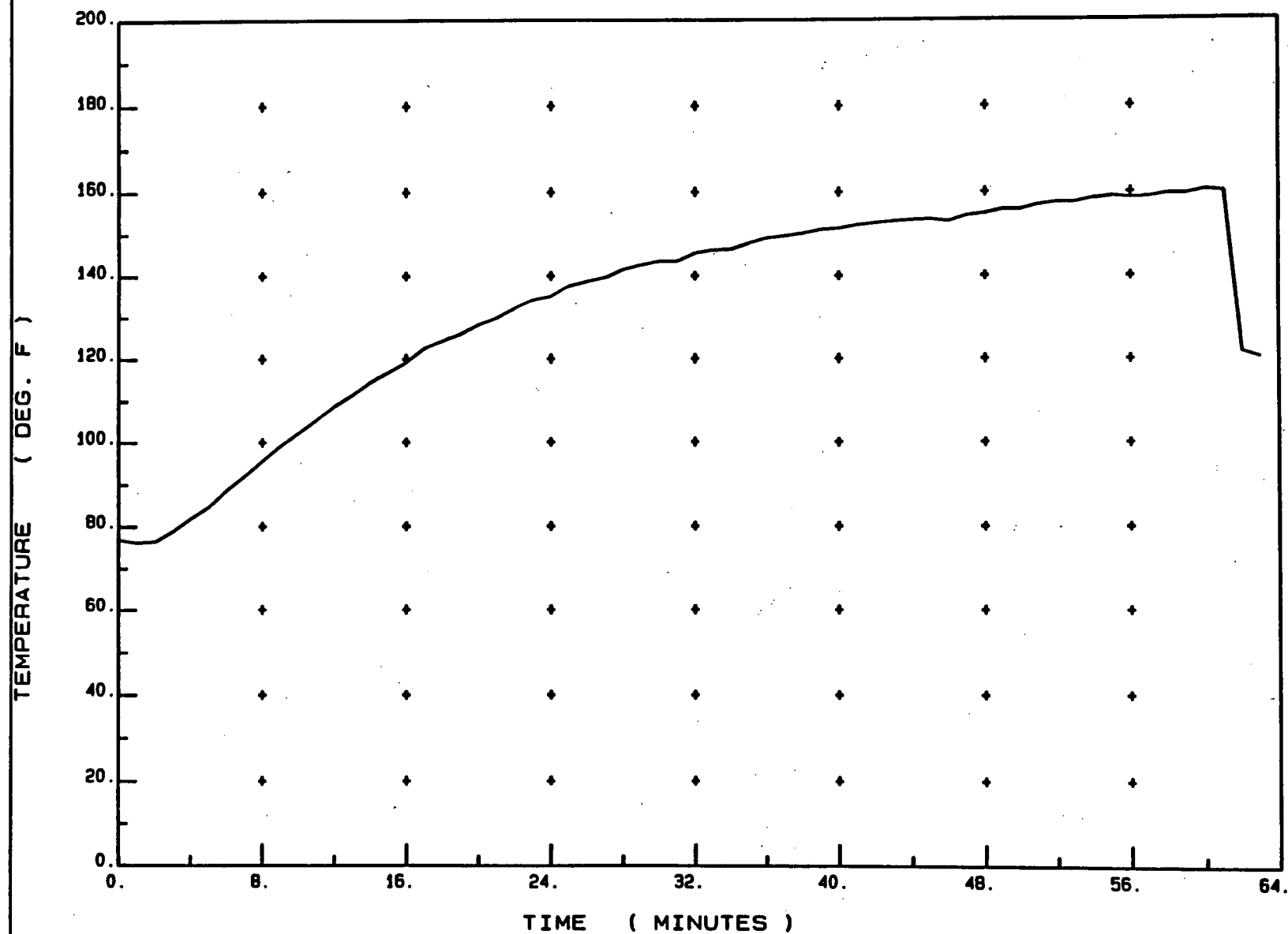


/log/data/TEST1/950328153828.495

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

T/C#3

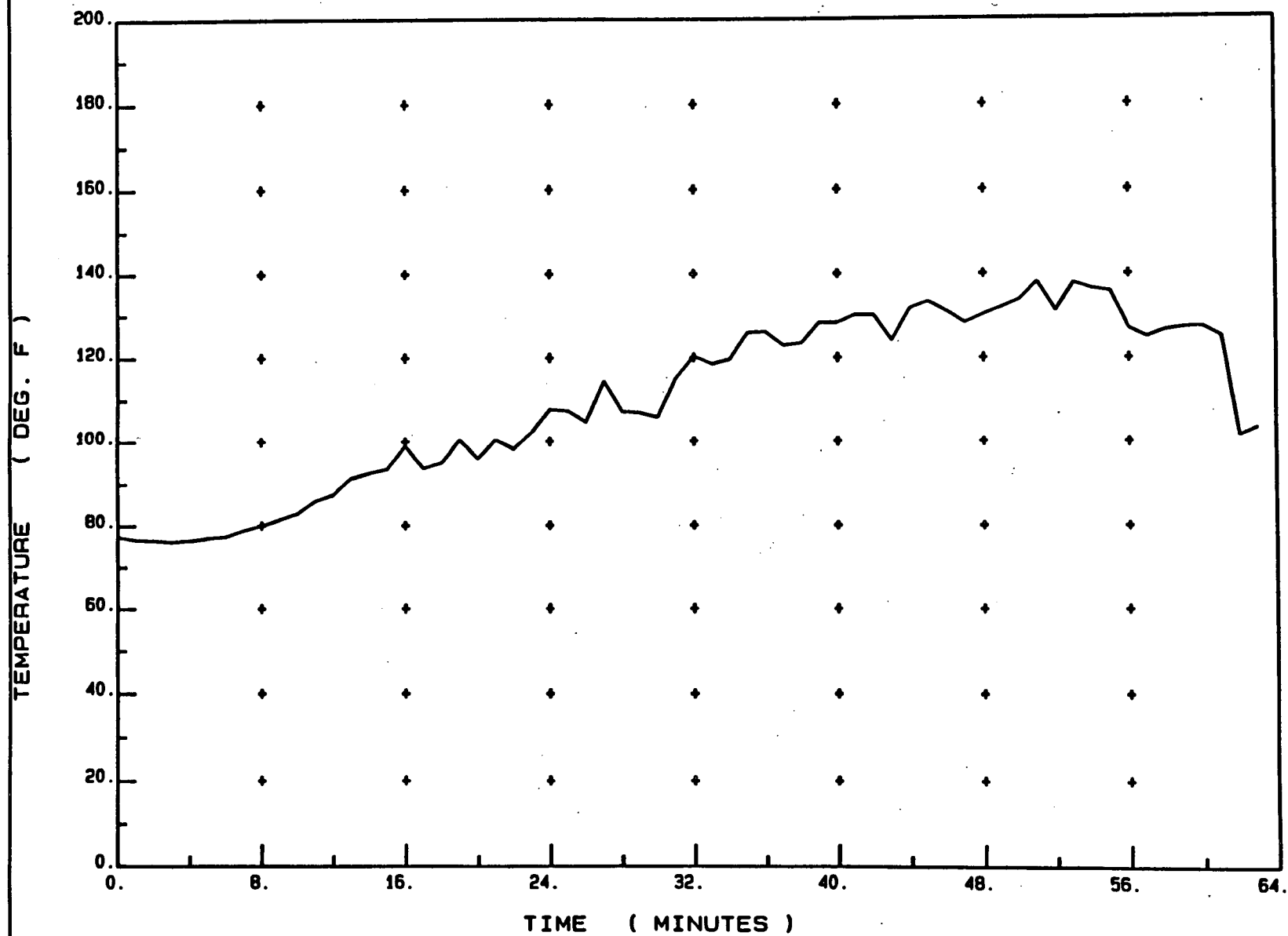


/log/data/TEST1/950328153828.495

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

T/C#4

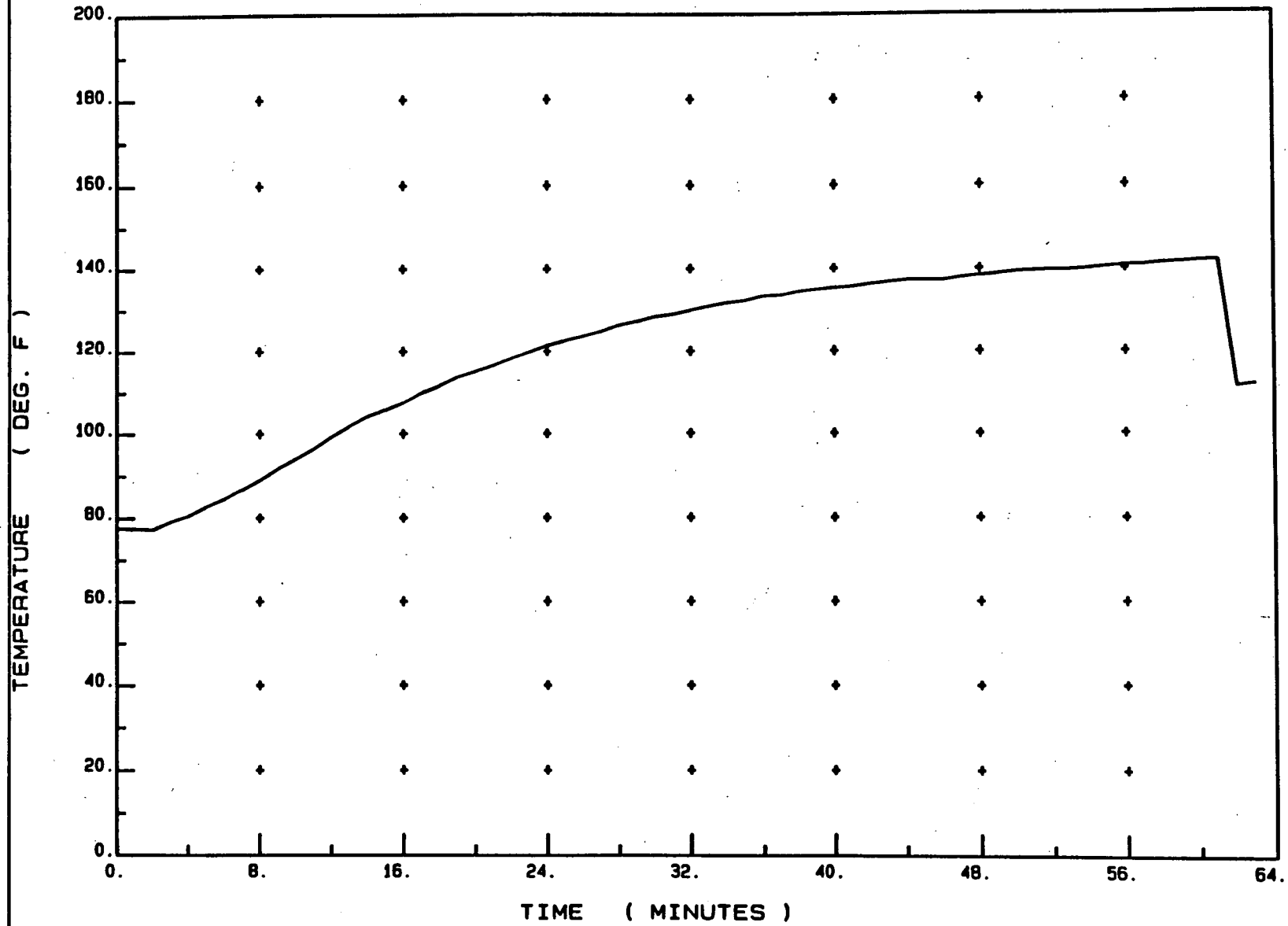


wyle

/100/data/TEST1/950328153828.495

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

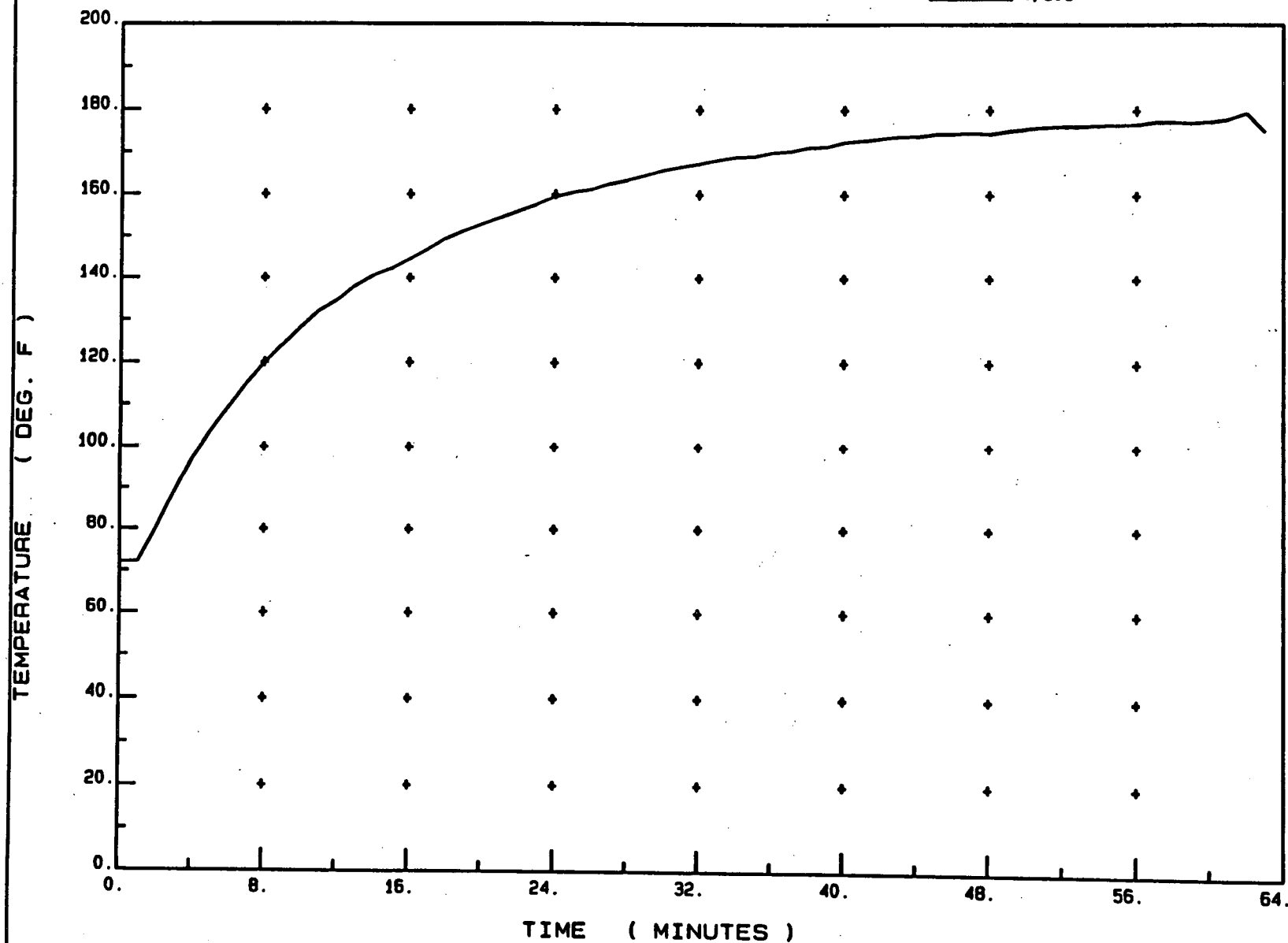
—— T/C#5



wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

T/C#6

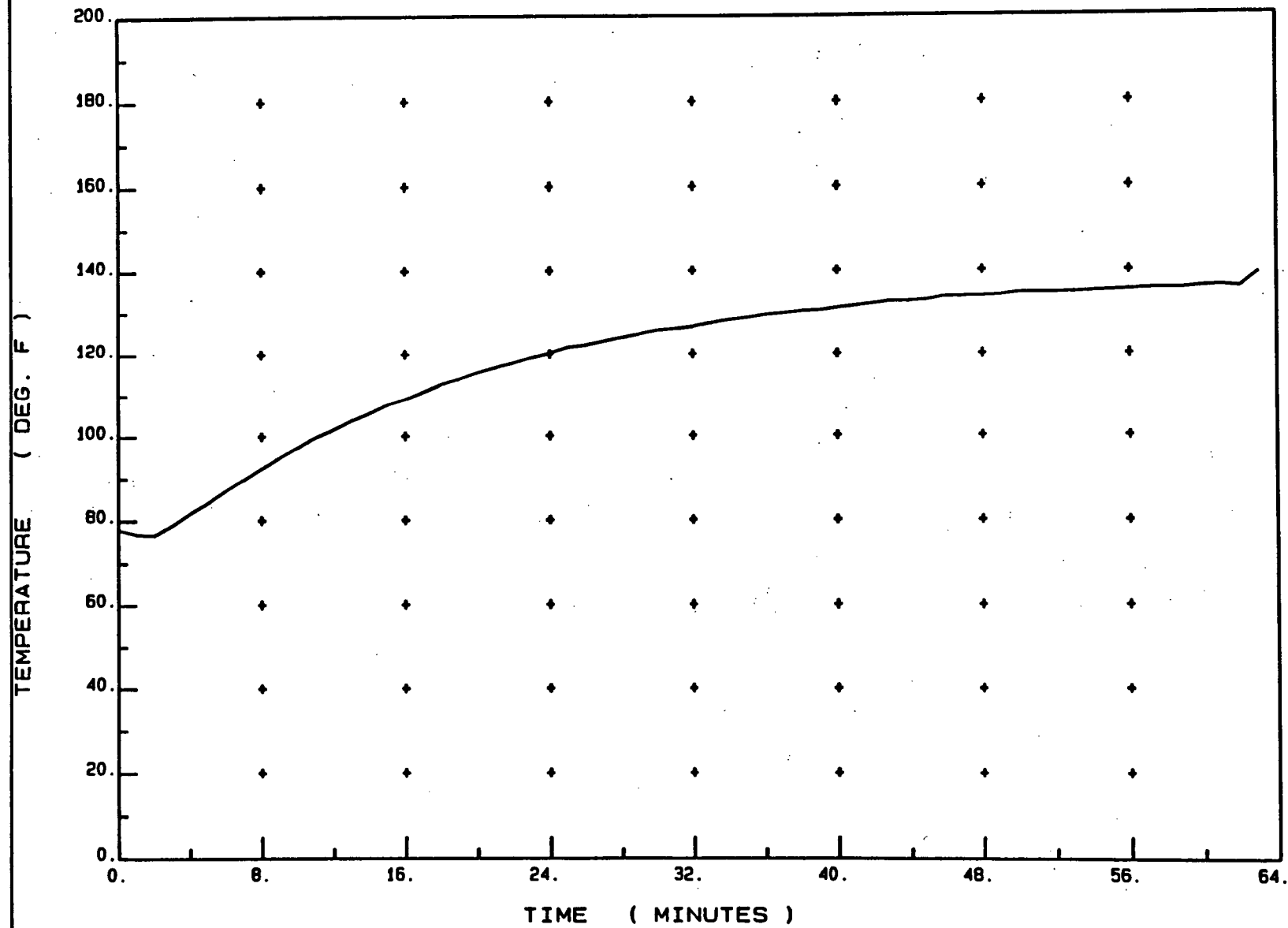


/ioq/data/TEST1/950328153828.495

wyle

CON. ED. 45971-00  
POST-RADIATION HYDROGEN TEST WET  
03/28/95

T/C#7



wyle

**This page intentionally left blank.**

**APPENDIX V**  
**INSTRUMENTATION EQUIPMENT SHEETS**

**This page intentionally left blank.**

INSTRUMENTATION EQUIPMENT SHEET

PAGE 1 0

F 1

03/06/97

TECHNICIAN: G. STEWART

JOB NUMBER: 45971-00

CUSTOMER: CONSOLIDATED EDN

TEST AREA: ENV LAB

TYPE TEST: RECEIPT INSPECTION

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	SCALES	OHAUS	126	N/A	100145	45 LBS	1 GRAM	12/27/96	12/26/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION

G. Stewart 3-6-97

CHECKED & RECEIVED BY

R. Hancock 3/6/97

Q.A.

[Signature] 3/6/97

Page No. 64  
Test Report No. 45971-1  
INSTRUMENTATION EQUIPMENT SHEET

PAGE 10

F 1

DATE: 03/14/97  
TECHNICIAN: P. WADSWORTH

JOB NUMBER: 45971-00  
CUSTOMER: CON ED

TEST AREA: LOCA  
TYPE TEST: HYDROGEN TEST DRY

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	FLOWMETER	BROOKS	R9M253	33547	R33547	2-10CFM	CERT	03/03/97	03/03/98
2	THERMOMETER DIG	FLUKE	2190A	208	094906	MULTI	.03%	02/25/97	05/26/97
3	DATA SYS	DAYTRONIC	10K6	N/A	101936	MULTI	MFG	06/03/96	06/03/97
4	STOP WATCH	VWR	62379218	9569125	112561	9HR/59MIN/59SEC	.5SEC	02/06/97	08/05/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION

P. Wadsworth  
3/14/97

CHECKED & RECEIVED BY

R. Hardy 3/14/97  
Q.A. R. Hamilton 3/14/97

INSTRUMENTATION EQUIPMENT SHEET

PAGE 10

F 1

03/14/97  
TECHNICIAN: P. WADSWORTH

JOB NUMBER: 45971-00  
CUSTOMER: CON ED

TEST AREA: CAL LAB  
TYPE TEST: WEIGHT TEST

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	SCALE	SETRA	SUPER CT	669980	112286	27 LBS	.0005 LB	03/06/97	03/06/98
2	STOP WATCH	VWR	62379218	9569125	112561	9HR/59MIN/59SEC	.5SEC	02/06/97	08/05/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION P. Wadsworth  
3/14/97

CHECKED & RECEIVED BY R. Haug 3/14/97  
Q.A. W. Hamilton 3/14/97

Page No. 66  
Test Report No. 45971-1  
INSTRUMENTATION EQUIPMENT SHEET

PAGE 10

F 1

DATE: 03/14/97  
TECHNICIAN: P. WADSWORTH

JOB NUMBER: 45971-00  
CUSTOMER: CON ED

TEST AREA: LOCA  
TYPE TEST: HYDROGEN TEST NET

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	FLOWMETER	BROOKS	R9M253	33547	R33547	2-10CFM	CERT	03/03/97	03/03/98
2	THERMOMETER DIG	FLUKE	2190A	208	094906	MULTI	.03%	02/25/97	05/26/97
3	DATA SYS	DAYTRONIC	10K6	N/A	101936	MULTI	MFG	06/03/96	06/03/97
4	STOP WATCH	VWR	62379218	9569125	112561	9HR/59MIN/59SEC	.5SEC	02/06/97	08/05/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION

P. Wadsworth  
3/14/97

CHECKED & RECEIVED BY

R. Haug 3/14/97  
Q.A. TD Hunter 3/14/97

INSTRUMENTATION EQUIPMENT SHEET

PAGE 1 0

F 1

03/24/97

TECHNICIAN: B. WILBOURN

JOB NUMBER: 45971-00

CUSTOMER: CON ED

TEST AREA: LOCA

TYPE TEST: RADIATION EXPOSURE

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	TEMP IND	DORIC	402A	106718	011832	-328 TO 752°F	2.5°F	01/30/97	07/29/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION

B. Wilbourn 3-24-97

CHECKED & RECEIVED BY

R. Hand 3/24/97

Q.A.

TR Hamilton 3/24/97

INSTRUMENTATION EQUIPMENT SHEET

PAGE 1 0

F 1

DATE: 03/24/97  
TECHNICIAN: B. WILBOURN

JOB NUMBER: 45971-00  
CUSTOMER: CON ED

TEST AREA: LOCA  
TYPE TEST: POST-RAD HYD EXP.

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	STOP WATCH	VWR	62379218	1055166	112313	9HR/59MIN/59SEC	.5 sec	02/14/97	08/13/97
2	FLOWMETER	BROOKS	R9M253	33547	R33547	2-10CFM	CERT	03/03/97	03/03/98
3	DATA SYS	DAYTRONIC	10K6	N/A	101936	MULTI	MFG	06/03/96	06/03/97
4	THERMOMETER DIG	FLUKE	2190A	208	094906	MULTI	.03%	02/25/97	05/26/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION

Paul Wadsworth  
3/24/97

CHECKED & RECEIVED BY

R. Hand 3/25/97  
Q.A. TR Hamilton 3/25/97

**TYPE TEST: POST-RAD WEIGHT TEST**

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	STOP WATCH	WHR	62379218	1055166	112313	9HR/59MIN/59SEC	.5 sec	02/14/97	08/13/97
2	SCALE	SETRA	SUPER CT	669980	112286	27 LBS	.0005 LB	03/06/97	03/06/98

## PRESENTATION

**CHECKED & RECEIVED BY**

Q.A. Bonda Bonmista 3 Jan 197

Page No. 70  
Test Report No. 45971-1  
INSTRUMENTATION EQUIPMENT SHEET

PAGE 10

F 1

DATE: 03/25/97  
TECHNICIAN: B. WILBOURN

JOB NUMBER: 45971-00  
CUSTOMER: CON ED

TEST AREA: LOCA  
TYPE TEST: POST-RAD HYD EXP

NO.	INSTRUMENT	MANUFACTURER	MODEL#	SERIAL #	WYLE #	RANGE 1	ACCURACY 1	CALDATE	CALDUE
1	STOP WATCH	VWR	62379218	1055166	112313	9HR/59MIN/59SEC	.5 sec	02/14/97	08/13/97
2	FLOWMETER	BROOKS	R9M253	33547	R33547	2-10CFM	CERT	03/03/97	03/03/98
3	DATA SYS	DAYTRONIC	10K6	N/A	101936	MULTI	MFG	06/03/96	06/03/97
4	THERMOMETER DIG	FLUKE	2190A	208	094906	MULTI	.03%	02/25/97	05/26/97

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION B. Wilbourn 3-28-97

CHECKED & RECEIVED BY B. Aant 3/28/97

Q.A. Brenda Bannister 3/28/97

**APPENDIX VI**  
**HYDROGEN GAS CERTIFICATIONS**

**This page intentionally left blank.**

**AIR LIQUIDE**

6 Fairmont Pkwy  
LaPorte, TX 77571

Phone (281) 474-8400 Fax (281) 474-8419

USA (800) 248-1427

CERTIFICATION OF CYLINDER #

**LA-TX-075565**

Page No. 73  
Test Report No. 45971-1

Customer : Post Airgas

Date Made : 3/5/97

Mix # : LAPX21187

P.O. Number : 1379

AGZ Doc. # : 1651160-1C

Item Number :

Valve Type : CGA 590

Blend Type : GAS CERTIFIED PLUS

Cyl. Size : 49, 235 SCF

**Equipment Used**

Mole	Components	Scale	Instr.	Standard
Balance	AIR	0007		
1.00 %	HYDROGEN	0080		

Valid Until: 4 March, 2002

**Requested Notes**

**Accuracy of Standard**

Certified* and Certified Plus			Weight Tracable	
	Non-React.	React.		
1 % - 50 %	± 1% (*±2%)	± 2%	20 ppm - 50 %	± 1%
100 ppm - <1 %	± 2%	± 3%	2 ppm - <20 ppm	± 2%
10 ppm - <100 ppm	± 3%	± 5%		
1 ppm - <10 ppm	± 10%	± 10%		

Improper storage or use may affect the accuracy of this standard.

This mixture was prepared and certified by weight using one or more scales certified against weights traceable to N.I.S.T. #822/254143-94.

Prepared by



**AIR LIQUIDE**

11426 Fairmont Pkwy

LaPorte, TX 77571

Phone (281) 474-8400 Fax (281) 474-8419

USA (800) 248-1427

Page No. 74  
Test Report No. 45971-1

Customer : Post Airgas

Date Made : 3/5/97

Mix # : LAPX21186

P.O. Number : 1379

AGZ Doc. # : 1651160-1B

Item Number:

Valve Type :

Blend Type : GAS CERTIFIED PLUS

Cyl. Size : 49, 235 SCF

## CERTIFICATION OF CYLINDER #

**19035**Equipment Used

Mole	Components	Scale	Instr.	Standard
Balance	AIR	0007		
0.999 %	HYDROGEN	0080		

Valid Until: 4 March, 2002

Requested Notes	Accuracy of Standard			
	Certified* and Certified Plus		Weight Tracable	
		Non-React.	React.	
	1 % - 50 %	± 1% (*±2%)	± 2%	20 ppm - 50 % ± 1%
	100 ppm - <1 %	± 2%	± 3%	2 ppm - <20 ppm ± 2%
	10 ppm - <100 ppm	± 3%	± 5%	
	1 ppm - <10 ppm	± 10%	± 10%	

Improper storage or use may affect the accuracy of this standard.

This mixture was prepared and certified by weight using one or more scales certified against weights traceable to N.I.S.T. #822/254143-94.

Prepared by



**AIR LIQUIDE**Page No. 75  
Test Report No. 45971-16 Fairmont Pkwy  
LaPorte, TX 77571

Phone (281) 474-8400 Fax (281) 474-8419

USA (800) 248-1427

**CERTIFICATION OF CYLINDER #  
47858**

Customer : Post Airgas

Date Made : 3/5/97

Mix # : LAPX21185

P.O. Number : 1379

AGZ Doc. # : 1651160-1A

Item Number :

Valve Type : CGA 590

Blend Type : GAS CERTIFIED PLUS

Cyl. Size : 49, 235 SCF

**Equipment Used**

Mole	Components	Scale	Instr.	Standard
Balance	AIR	0007		
1.01 %	HYDROGEN	0080		

**Valid Until: 4 March, 2002****Requested Notes****Accuracy of Standard**

Certified* and Certified Plus			Weight Tracable	
	Non-React.	React.		
1 % - 50 %	± 1% (*±2%)	± 2%	20 ppm - 50 %	± 1%
100 ppm - <1 %	± 2%	± 3%	2 ppm - <20 ppm	± 2%
10 ppm - <100 ppm	± 3%	± 5%		
1 ppm - <10 ppm	± 10%	± 10%		

Improper storage or use may affect the accuracy of this standard.

This mixture was prepared and certified by weight using one or more scales certified against weights traceable to N.I.S.T. #822/254143-94.

Prepared by



**AIR LIQUIDE**

11426 Fairmont Pkwy

LaPorte, TX 77571

Phone (281) 474-8400 Fax (281) 474-8419

USA (800) 248-1427

Page No. 76  
Test Report No. 45971-1

Customer : Post Airgas

Date Made : 3/26/97

Mix # : LAPX22003

P.O. Number : 2330

AGZ Doc. # : 1677961-1A

Item Number :

Valve Type : CGA 590

Blend Type : GAS CERTIFIED

Cyl. Size : 44, 211 SCF

**CERTIFICATION OF CYLINDER #****T-23930****Equipment Used**

Mole	Components	Scale	Instr.	Standard
Balance	ULTRA ZERO AIR	4203		
1.00 %	HYDROGEN	4523		

**Valid Until: 25 March, 2002**

Requested Notes	Accuracy of Standard		
	Certified* and Certified Plus	Non-React.	React.
	1 % - 50 % $\pm 1\%$ (* $\pm 2\%$ )	$\pm 2\%$	$\pm 2\%$
	100 ppm - <1 % $\pm 2\%$	$\pm 3\%$	$\pm 3\%$
	10 ppm - <100 ppm $\pm 3\%$	$\pm 5\%$	$\pm 5\%$
	1 ppm - <10 ppm $\pm 10\%$	$\pm 10\%$	$\pm 10\%$

Improper storage or use may affect the accuracy of this standard.



This mixture was prepared and certified by weight using one or more scales certified against weights traceable to N.I.S.T. #822/254143-94.

Prepared by 

**AIR LIQUIDE**Page No. 77  
Test Report No. 45971-16 Fairmont Pkwy  
Lafayette, TX 77571

Phone (281) 474-8400 Fax (281) 474-8419

USA (800) 248-1427

Customer : Post Airgas

Date Made : 3/26/97

Mix # : LAPX22004

P.O. Number : 2330

AGZ Doc. # : 1677961-1B

Item Number:

Valve Type : CGA 590

Blend Type : GAS CERTIFIED

Cyl. Size : 44, 211 SCF

CERTIFICATION OF CYLINDER #

**K-117583**Equipment Used

Mole	Components	Scale	Instr.	Standard
Balance	ULTRA ZERO AIR	4203		
0.999 %	HYDROGEN	4523		

Valid Until: 25 March, 2002

## Requested Notes

## Accuracy of Standard

Certified* and Certified Plus			Weight Tracable	
	Non-React.	React.		
1 % - 50 %	± 1% (*±2%)	± 2%	20 ppm - 50 %	± 1%
100 ppm - <1 %	± 2%	± 3%	2 ppm - <20 ppm	± 2%
10 ppm - <100 ppm	± 3%	± 5%		
1 ppm - <10 ppm	± 10%	± 10%		

Improper storage or use may affect the accuracy of this standard.



This mixture was prepared and certified by weight using one or more scales certified against weights traceable to N.I.S.T. #822/254143-94.

Prepared by 


**AIR LIQUIDE**

11426 Fairmont Pkwy

LaPorte, TX 77571

Phone (281) 474-8400 Fax (281) 474-8419

USA (800) 248-1427

 Page No. 78  
 Test Report No. 45971-1

Customer : Post Air Gas

Date Made : 3/13/97

Mix # : LAPX21584

P.O. Number: 1982

AGZ Doc. # : 1664451-1A

Item Number:

Valve Type : CGA 590

Blend Type : GAS CERTIFIED PLUS

Cyl. Size : 44, 105 SCF

CERTIFICATION OF CYLINDER #

**2A-41590**
Equipment Used

Mole	Components	Scale	Instr.	Standard
Balance	ULTRA ZERO AIR	0007		
1.03 %	HYDROGEN	0080		

Valid Until: 12 March, 2002

Requested Notes

Accuracy of Standard

Certified* and Certified Plus	Accuracy of Standard		Weight Traceable
	Non-React.	React.	
1 % - 50 % ± 1% (±2%)	± 2%	± 2%	20 ppm - 50 % ± 1%
100 ppm - <1 % ± 2%	± 3%	± 3%	2 ppm - <20 ppm ± 2%
10 ppm - <100 ppm ± 3%	± 5%	± 5%	
1 ppm - <10 ppm ± 10%	± 10%	± 10%	

Improper storage or use may affect the accuracy of this standard.

This mixture was prepared and certified by weight using one or more scales certified against weights traceable to N.I.S.T. #822/254143-94.

Prepared by



**APPENDIX VII**

**WYLE LABORATORIES TEST PROCEDURE 45971, REVISION A**

**This page intentionally left blank.**

# TEST PROCEDURE

**wyle**  
laboratories

ville, Alabama 35807  
(205) 830-2109, Phone (205) 837-4411

Page No. 81  
Test Report No. 45971-1

TEST PROCEDURE NO. 45971

DATE January 16, 1997

Revision A February 10, 1997

## TEST PROCEDURE FOR FUNCTIONAL TESTING AND RADIATION EXPOSURE OF A PASSIVE AUTOCATALYTIC RECOMBINER PLATE

FOR  
Consolidated Edison Company

APPROVED BY: \_\_\_\_\_

FOR: \_\_\_\_\_

APPROVED BY

PROJECT MANAGER:

*D. Smith* 1/22/97  
D. Smith

APPROVED BY: \_\_\_\_\_

FOR: \_\_\_\_\_

APPROVED BY

QUALITY ENGINEER:

*R. Thomas* 1-22-97  
R. Thomas

APPROVED BY: \_\_\_\_\_

FOR: \_\_\_\_\_

APPROVED BY

PROJECT ENGINEER:

*R. Hardy* 1/17/97  
R. Hardy

### REVISIONS

REV. NO.	DATE	PAGES AFFECTED	BY	APPL.	DESCRIPTION OF CHANGES
A	2/10/97	2 and 3	RDH <i>RDH</i> 2/10/97	<i>RDH</i> 2/10/97 2-12-97	Revised per comments faxed to Wyle 2/4/97 by Polestar
A	2/10/97	5 and 6	RDH <i>RDH</i> 2/10/97	<i>RDH</i> 2/10/97 2-12-97	Added new figures
A	2/10/97	All	RDH <i>RDH</i> 2/10/97	<i>RDH</i> 2/10/97 2-12-97	Adjusted page numbers

COPYRIGHT BY WYLE LABORATORIES. THE RIGHT TO REPRODUCE, COPY, EXHIBIT, OR OTHERWISE UTILIZE ANY OF THE MATERIAL CONTAINED HEREIN WITHOUT THE EXPRESS PRIOR PERMISSION OF WYLE LABORATORIES IS PROHIBITED. THE ACCEPTANCE OF A PURCHASE ORDER IN CONNECTION WITH THE MATERIAL CONTAINED HEREIN SHALL BE EQUIVALENT TO EXPRESS PRIOR PERMISSION.

(rdh)

Revision A

## 1.0 SCOPE

This document has been prepared by Wyle Laboratories for Consolidated Edison Company (Con Edison) to present the procedures for testing the specimen described in Paragraph 1.1 in accordance with the standards, specifications, and other documents listed in Paragraph 1.2. The purpose of the testing is to determine the effect of radiation exposure on a catalyst cartridge in terms of heatup after exposure to a known flow of hydrogen.

## 1.1 Specimen Description

The specimen for this test program consists of the following item manufactured by NIS Ingenieurgesellschaft MBH:

- One (1) Passive Autocatalytic Recombiner Cartridge, approximately 45 cm x 20 cm x 1 cm, with an approximate weight of 1.3 kg.

## 1.2 Qualification Standards, Specifications, and Documents

- Wyle Laboratories' Quotation No. 543/3515/DB.
- Consolidated Edison Company Purchase Order No. 618123.
- Consolidated Edison Company Request for Quotation IP-96-0676, dated 12/17/96.
- 10 CFR 21, "Reporting of Defects and Noncompliance."
- 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants."
- Wyle Laboratories' (Eastern Operations) Quality Assurance Program Manual, Revision 1.

## 2.0 TEST REQUIREMENTS

### 2.1 Receipt Inspection

An inspection shall be performed upon receipt of the specimen at Wyle Laboratories. The specimen shall be checked to ensure that it is as described in Paragraph 1.1. All data furnished with the specimen shall be recorded. The specimen shall be visually inspected for obvious physical damage. The weight of the specimen shall be taken at ambient room temperature and humidity for baseline weight purposes and recorded to the nearest gram. A photograph of the specimen as received shall be taken. Consolidated Edison shall provide the NIS records of the specimen's history for inclusion in the final test report.

### 2.2 Hydrogen Exposure Test - Dry

The specimen shall be subjected to a Hydrogen Exposure Test by placing it inside a test fixture similar to the one shown in Figure 1. A gas mixture of dry air with 1% hydrogen gas shall then be introduced into the test fixture at a known, fixed flow rate sufficient to provide 0.3 to 0.5 m/s gas velocity across the face of the cartridge (approximately 100 lpm). The air temperature shall be measured at the inlet to the specimen and the outlet of the specimen as shown in Figure 1. Additionally, the temperature in the catalyst bed, one-third from the bottom of the specimen shall be measured. The duration of the Hydrogen Exposure Test shall be as required to reach stable temperature conditions (less than 1% change in temperature per minute) or for one hour, whichever comes first.

### 2.3 Weight Test

The specimen shall be placed in a container of room-temperature tap water so that it is fully submerged. The specimen shall be allowed to soak for one hour in the water. Following the one-hour soak, the specimen shall be removed from the water and weighed every 5 minutes for 30 minutes to determine the effects of the water on the weight of the specimen.

## TEST REQUIREMENTS (continued)

### 2.4 Hydrogen Exposure Test - Wet

The specimen shall be subjected to a Hydrogen Exposure Test - wet, by taking it immediately from the conclusion of the Weight Test detailed in Paragraph 2.3 and subjecting it to a Hydrogen Exposure Test as detailed in Paragraph 2.2. A

### 2.5 Radiation Exposure

Prior to irradiation, the specimen shall be verified to be dry by weighing the specimen and confirming a return to essentially its baseline weight. The specimen shall be exposed to gamma radiation using a Cobalt-60 source. The total dose for the exposure shall be 1.0E7 rads gamma. A

The radiation exposure shall be measured as air equivalent gamma using a Cobalt-60 source at a dose rate not to exceed 0.5E6 rads per hour. The dose rate shall be measured at the geometric centerline of the specimen. The specimen shall be rotated, if necessary, during the radiation exposure to ensure a uniform dose distribution. The source, component, and dosimetry placement shall be documented.

One thermocouple shall be placed on the specimen to monitor catalyst temperature during the radiation exposure. The temperature shall be recorded periodically for a time sufficiently long to assure that the catalyst temperature will not exceed 150°C. A

### 2.6 Post-Radiation Hydrogen Exposure Test - Dry

The specimen shall be subjected to a Hydrogen Exposure Test - dry, as detailed in Paragraph 2.2. A

### 2.7 Post-Radiation Exposure Weight Test

The weight of the specimen shall be measured following the same procedure as Paragraph 2.3.

### 2.8 Post-Radiation Performance Test

The specimen shall be subjected to a Hydrogen Exposure Test - wet, as detailed in Paragraph 2.4. A

### 2.9 Post-Test Inspection

The specimen shall be visually inspected, and its condition shall be recorded.

## 3.0 TEST REPORTS

Two bound copies, and one unbound reproducible copy, of a test report describing the test requirements, procedures, and results shall be issued.

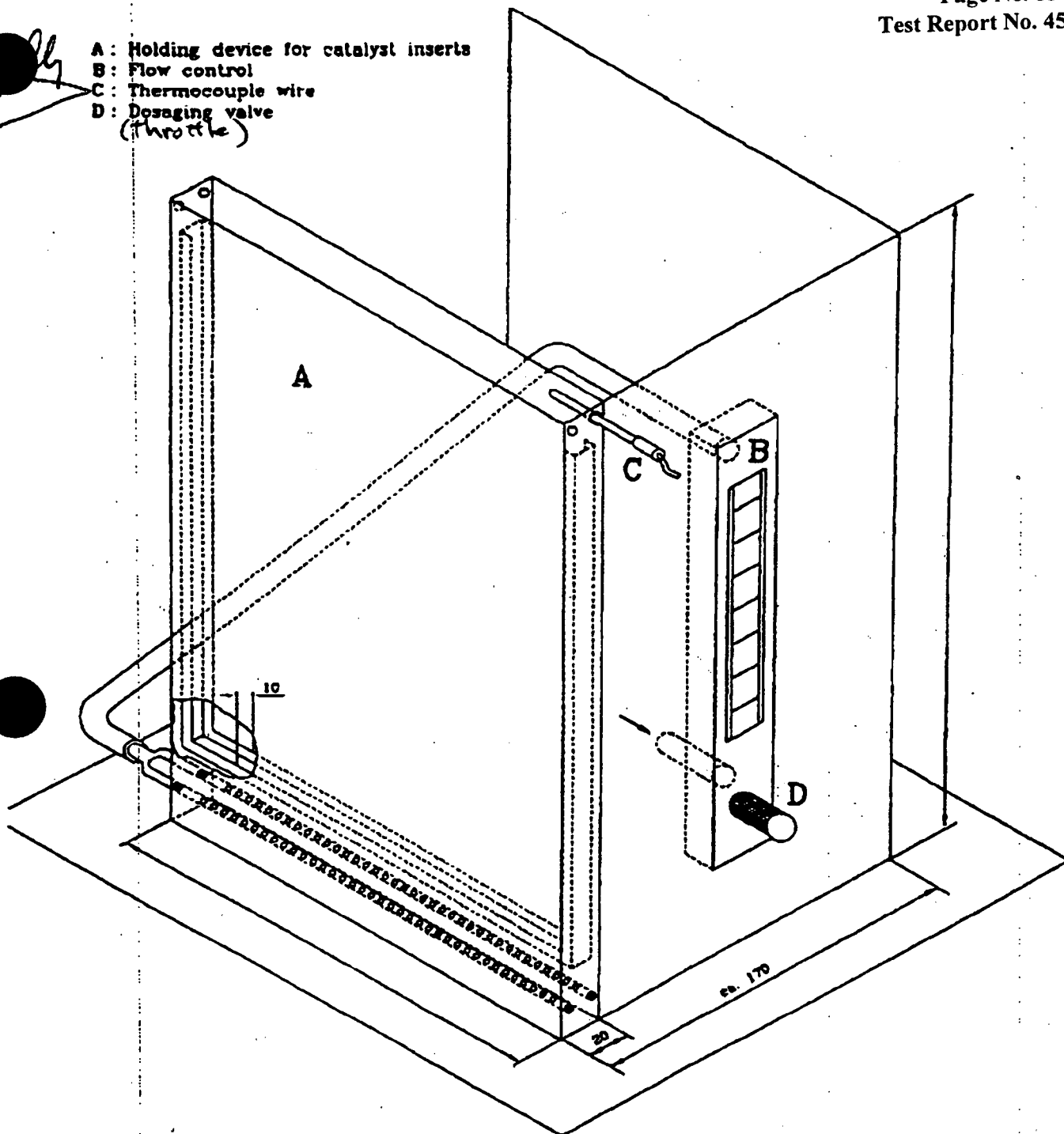
## 4.0 QUALITY ASSURANCE

The test program shall be performed under the requirements of Wyle Laboratories' Quality Assurance Program. This program follows the pertinent requirements of 10 CFR 50 Appendix B, ANSI N45.2, and the daughter standards. Defects shall be reportable under the requirements of 10 CFR Part 21.

## 5.0 INSTRUMENTATION

All instrumentation, measuring, and test equipment to be used in the performance of this test program shall be calibrated in accordance with Wyle Laboratories' Quality Assurance Program, which complies with the requirements of ANSI/NCSL Z540-1, ISO 10012-1, and Military Specification MIL-STD-45971A. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

- 4
- A: Holding device for catalyst inserts
  - B: Flow control
  - C: Thermocouple wire
  - D: Dosaging valve (throttle)



NIS/Polestar PROPRIETARY

FIGURE 1

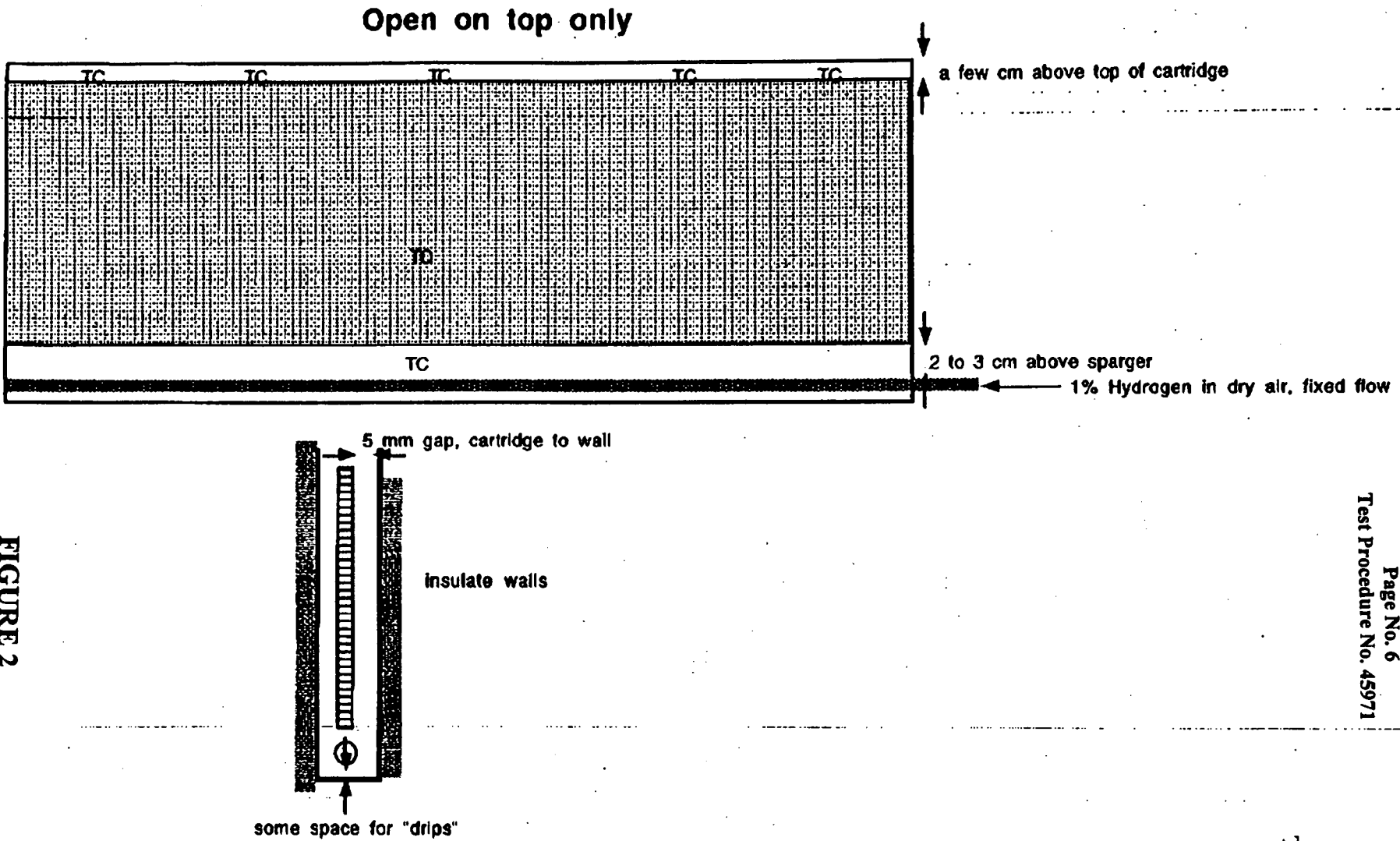


FIGURE 2